Drive^{IT} Low Voltage AC Drives

User's Manual

ACS550-01 Drives (0.75…90 kW)
ACS550-U1 Drives (1…150 HP)

ABB

ACS550 Drive Manuals

GENERAL MANUALS

ACS550-01/U1 User's Manual (0.75…90 kW) / (1…150 HP)

- Safety
- Installation
- Start-Up
- Diagnostics
- Maintenance
- Technical Data

ACS550-02/U2 User's Manual (110…355 kW) / (150…550 HP)

- Safety
- Installation
- Start-Up
- Diagnostics
- Maintenance
- Technical Data

ACS550 Technical Reference Manual

- Detailed Product Description
  - Technical product description including Dimensional drawings
  - Cabinet mounting information including power losses
  - Software and control including complete parameter descriptions
  - User interfaces and control connections
  - Complete options descriptions
  - Spare parts
  - Etc.
- Practical Engineering Guides
  - PID & PFC engineering guides
  - Dimensioning and sizing guidelines
  - Diagnostics and Maintenance information
  - Etc.

OPTION MANUALS

(Fieldbus Adapters, I/O Extension Modules etc., manuals delivered with optional equipment)

Relay Output Extension Module (typical title)

- Installation
- Start-Up
- Diagnostics
- Technical Data

Safety

Warning! The ACS550 adjustable speed AC drive should ONLY be installed by a qualified electrician.

Warning! Even when the motor is stopped, dangerous voltage is present at the Power Circuit terminals U1, V1, W1 and U2, V2, W2 and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.

Warning! Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.

Warning! Even when power is removed from the input terminals of the ACS550, there may be dangerous voltage (from external sources) on the terminals of the relay outputs R01...R03.

Warning! When the control terminals of two or more drive units are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the units or an external supply.

Warning! The ACS550-01/U1 is not a field repairable unit. Never attempt to repair a malfunctioning unit; contact the factory or your local Authorized Service Center for replacement.

Warning! The ACS550 will start up automatically after an input voltage interruption if the external run command is on.

Warning! The heat sink may reach a high temperature. See "Technical Data" on page 127.

Warning! If the drive will be used in a floating network, remove screws at EM1 and EM3 (Frame size R1...R4), or F1 and F2 (Frame size R5 or R6). See diagrams on page 17 and page 16 respectively.

Note! For more technical information, contact the factory or your local ABB sales representative.

Use of Warnings and Notes

There are two types of safety instructions throughout this manual:

- Notes draw attention to a particular condition or fact, or give information on a subject.
- Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. The warning symbols are used as follows:

Dangerous voltage warning warns of high voltage which can cause physical injury and/or damage to the equipment.

General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment

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Installation

Study these installation instructions carefully before proceeding. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**

Warning! Before you begin read "Safety" on page 3.

Installation Flow Chart

The installation of the ACS550 adjustable speed AC drive follows the outline below. The steps must be carried out in the order shown. At the right of each step are references to the detailed information needed for the correct installation of the unit.

Task	See
PREPARE for installation	"Preparing for Installation" on page 7.
UNPACK the drive	"Unpack the Drive" on page 14.
PREPARE the Mounting Location	"Prepare the Mounting Location" on page 14.
REMOVE the front cover	"Remove Front Cover" on page 14.
MOUNT the drive	"Mount the Drive" on page 15.
INSTALL wiring	"Install the Wiring" on page 15.
CHECK installation	"Check Installation" on page 23.
RE-INSTALL the cover	"Re-install Cover" on page 23.
APPLY power	"Apply Power" on page 23.
START-UP	"Start-Up" on page 24.

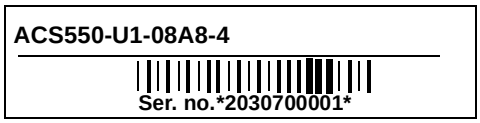
Preparing for Installation

Drive Identification

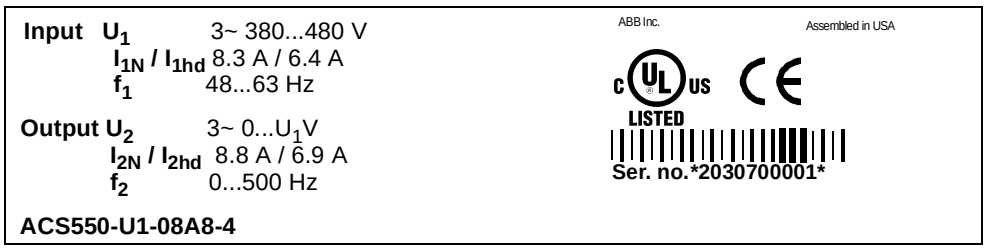
Drive Labels

To determine the type of drive you are installing, refer to either:

- Serial number label attached on upper part of the chokeplate between the mounting holes.

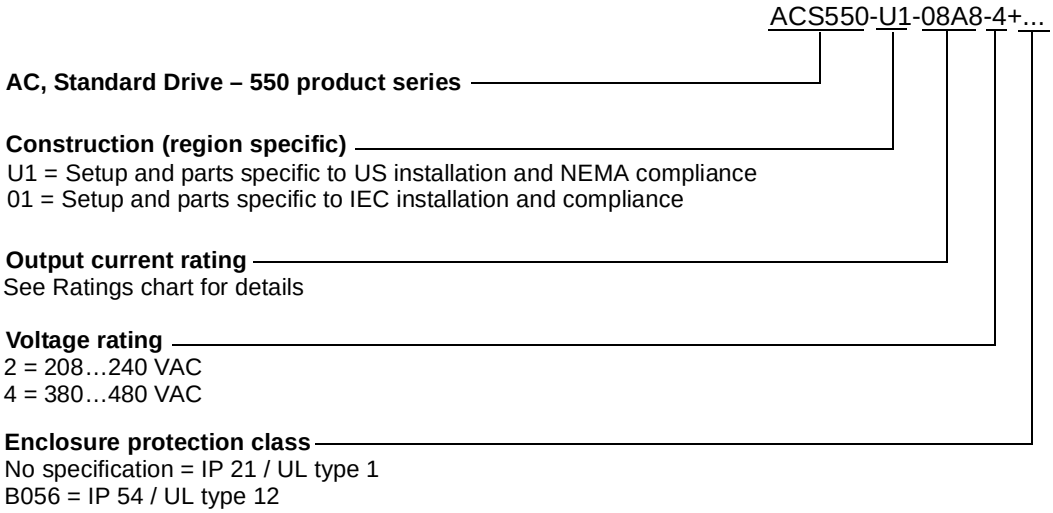


- Type code label attached on the heat sink – on the right side of the unit cover.



Type Code

Use the following chart to interpret the type code found on either label.


ACS550-U1-08A8-4+...
AC, Standard Drive – 550 product series
Construction (region specific)
U1 = Setup and parts specific to US installation and NEMA compliance
01 = Setup and parts specific to IEC installation and compliance
Output current rating
See Ratings chart for details
Voltage rating
2 = 208…240 VAC
4 = 380…480 VAC
Enclosure protection class
No specification = IP 21 / UL type 1
B056 = IP 54 / UL type 12

Ratings and Frame Size

The chart in "Ratings" on page 127 lists technical specifications, and identifies the drive's frame size – significant, since some instructions in this document, vary, depending on the drive's frame size. To read the Ratings table, you need the "Output current rating" entry from the type code. Also, when using the Ratings table, note that the table is broken into sections based on the drive's "Voltage rating".

Motor Compatibility

The motor, drive, and supply power must be compatible:

Motor Specification	Verify	Reference
Motor type	3-phase induction motor	–
Nominal current	0.2…2.0 * motor nominal current I_{hd}	• Type code label on drive, entry for "Output I" (current), or • Type code on drive and rating table in **"Technical Data"** on page **127**.
Nominal frequency	10…500 Hz	–
Voltage range	Motor is compatible with the ACS550 voltage range.	208…240 V (for ACS550-X1-XXXX-2) or 380…480 V (for ACS550-X1-XXXX-4)

Tools Required

To install the ACS550 you need the following:

- Screwdrivers (as appropriate for the mounting hardware used)
- Wire stripper
- Tape measure
- Drill
- Mounting hardware: screws or nuts and bolts, four each. The type of hardware depends on the mounting surface and the frame size:

Frame Size	Mounting Hardware	
R1…R4	M5	#10
R5	M6	1/4 in
R6	M8	5/16 in

Suitable Environment and Enclosure

Confirm that the site meets the environmental requirements. To prevent damage prior to installation, store and transport the drive according to the environmental requirements specified for storage and transportation. See "Ambient Conditions" on page 134.

Confirm that the enclosure is appropriate, based on the site contamination level:

- IP 21 / UL type 1 enclosure. The site must be free of airborne dust, corrosive gases or liquids, and conductive contaminants such as condensation, carbon dust, and metallic particles.

Suitable Mounting Location

Confirm that the mounting location meets the following constraints:

- The drive must be mounted vertically on a smooth, solid surface, and in a suitable environment as defined above.

- The minimum space requirements for the drive are the outside dimensions (see "Outside Dimensions" on page 132), plus air flow space around the unit (see "Cooling" on page 131).
- The distance between the motor and the drive is limited by the maximum motor cable length. See "Motor Connection" on page 130.
- The mounting site must support the drive's modest weight and noise output. See "Dimensions, Weights and Noise" on page 131.

Wiring and EMC Considerations

Determine electro-magnetic compliance (EMC) requirements per local codes. See "Wiring and EMC Considerations" on page 9. In general:

- Follow local codes for cable size.
- Keep these four classes of wiring separated: input power wiring, motor wiring, control/communications wiring, and braking unit wiring.
- Refer to "Motor Cable" on page 10 for the motor cable length limit imposed by possible EMC requirements (CE or C-Tick).
- Refer to the specifications/recommendations in:
  "Input Power (Mains) Cables and Fuses" on page 129,
  "Cable Terminals" on page 129,
  "Input Power (Mains) Connection" on page 130, and
  "Motor Connection" on page 130.

EMC Instructions (Europe, Australia, and New Zealand)

This section describes conformance with EMC requirements (in Europe, Australia, and New Zealand). For installations in the Unites States and other locations without special EMC requirements, skip to "Control Cables" on page 13.

CE Marking (pending as of publication date)

A CE mark is attached to the ACS550 AC drive to verify that the drive follows the provisions of the European Low Voltage and EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used in European Economic Area. The EMC product standard EN 61800-3 covers the requirements stated for drives, such as the ACS550. ACS550 AC drives comply with the requirements stated in EN 61800-3 for Second Environment and First Environment, restricted distribution.

Product standard EN 61800-3 (Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods) defines **First Environment** as environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low voltage power supply network which supplies buildings used for domestic purposes.

Second Environment includes establishments other than those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

C-Tick Marking (pending as of publication date)

A C-tick mark is attached to the ACS550 AC drive to verify that the drive follows the provisions of the Australian Statuary Rules No 294, 1996, Radio communication (Compliance Labelling - Incidental Emissions) Notice and the Radio communication Act, 1989, and the Radio communication Regulations, 1993, of New Zealand.

The statutory rules define the essential requirements for emissions of electrical equipment used in Australia and New Zealand. The standard AS/NZS 2064, 1997, Limits and methods of measurement of electronic disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment, covers the detailed requirements for three-phase drives, such as the ACS550 drive.

ACS550 drives comply with the AS/NZS 2064, 1997, limits for class A equipment. Class A equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage network which supplies buildings used for domestic purposes. The compliance is valid with the following provisions:

- The motor and control cables are chosen as specified in this manual.
- The installation rules of this manual are followed.

Cabling Instructions

Keep individual un-screened wires between the cable clamps and the screw terminals as short as possible. Route control cables away from power cables.

Input Power (Mains) Cable

A four conductor cable (three phases and ground/protective earth) is recommended for the input power cabling. Shielding is not necessary. Dimension the cables and fuses in accordance with the input current. Always pay attention to local codes when sizing the cables and fuses.

The input power connectors are at the bottom of the drive. Input power cable routing must be done so that the distance from the sides of the drive is at least 20 cm (8 in) to avoid excessive radiation to the input power cable. In the case of shielded cable, twist the cable screen wires together into a bundle not longer than five times its width and connect to the PE terminal of the drive. (Or PE terminal of input filter, if present.)

Line current harmonics

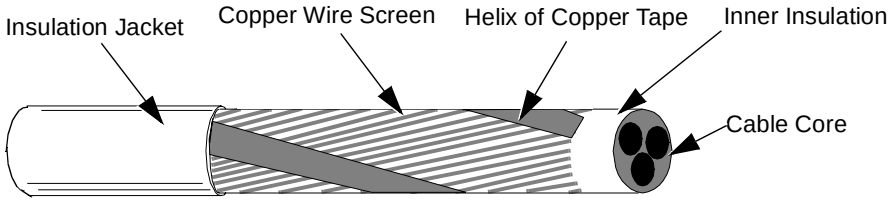
The ACS550 is professional equipment to be used in trades, professions, or industries, and is not intended for sale to the general public. The current harmonic levels under rated load conditions are available on request.

Motor Cable

Minimum Requirement (CE & C-Tick)

The motor cable must be a symmetrical three conductor cable with a concentric PE conductor or a four conductor cable with a concentric shield, however, a symmetrical

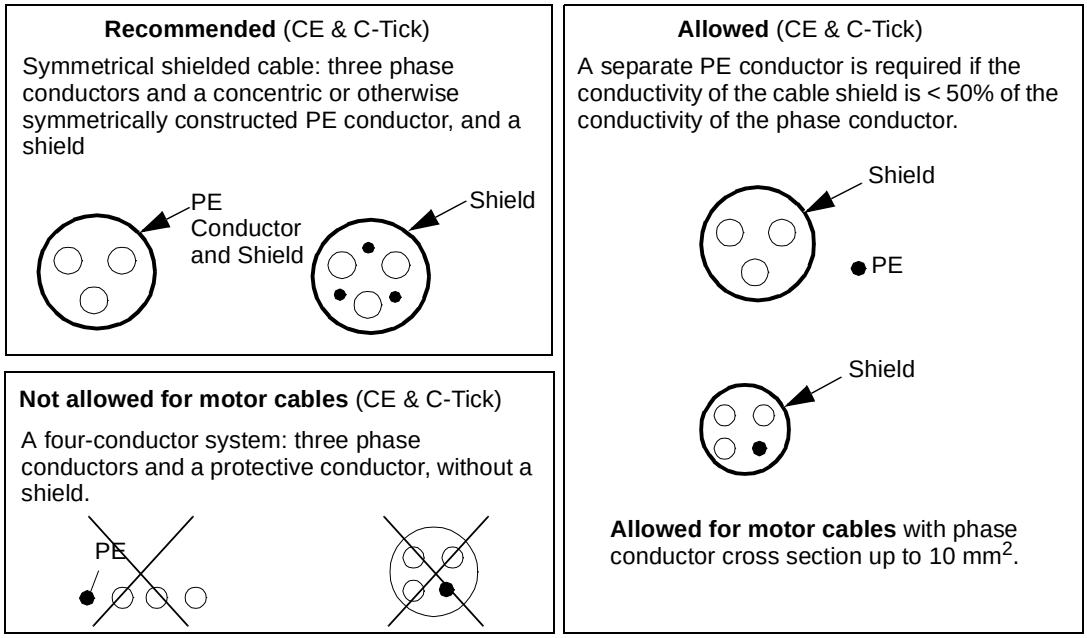
constructed PE conductor is always recommended. The following figure shows the minimum requirement for the motor cable screen (for example, MCMK, NK Cables).



* Input filters designed for ACS550 cannot be used in an isolated, or high impedance earthed industrial distribution network.

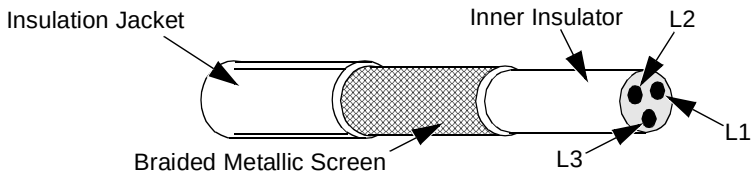
Recommendation for Conductor Layout

The following figure compares conductor layout features in motor cables.


Recommended (CE & C-Tick)
Symmetrical shielded cable: three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield
PE Conductor and Shield
Shield
Not allowed for motor cables (CE & C-Tick)
A four-conductor system: three phase conductors and a protective conductor, without a shield.
PE
Allowed (CE & C-Tick)
A separate PE conductor is required if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor.
Shield
PE
Shield
Allowed for motor cables with phase conductor cross section up to 10 mm2.

Effective Motor Cable Screens

The general rule for cable screen effectiveness is: the better and tighter the screen of the cable, the lower the radiated emission level. The following figure shows an example of an effective construction (for example Ölflex-Servo-FD 780 CP, Lappkabel or MCCMK, NK Cables).



Clamp the cable shield into the gland plate at the drive end and twist the cable screen wires together into a bundle not longer than five times its width and connect it to the terminal marked ⏚ (at the bottom right-hand corner of the drive), if you are using cable without a separate PE conductor.

At the motor end the motor cable screen must be earthed 360 degrees with an EMC cable gland or the screen wires must be twisted together into a bundle not longer than five times its width and connected to the PE terminal of the motor.

EN61800-3 and AS/NZS 2064, 1997, Class A Compliant Motor Cables

To comply with EN61800-3, First and Second Environment, Restricted Distribution, and AS/NZS 2064, 1997, Class A requirements, motor cables:

- less than or equal to 30 m (100 ft) do not require an RFI filter.
- longer than 30 m (100 ft) must be limited as specified in the table below. Follow the instructions in the filter package for all cable screen connections.

Drive Type	Filter	Switching Frequency (Parameter 2606)	
		1 or 4 kHz (1 or 4)	8 kHz (8)
		Maximum motor cable length	
ACS550-x1-03A3-4	ACS400-IF11-3	100 m (330 ft)	–
ACS550-x1-04A7-4			
ACS550-x1-05A4-4			
ACS550-x1-06A9-4			
ACS550-x1-08A8-4			
ACS550-x1-012A-4			
ACS550-x1-016A-4	ACS400-IF21-3	100 m (330 ft)	100 m (330 ft)
ACS550-x1-023A-4			
ACS550-x1-031A-4	ACS400-IF31-3	100 m (330 ft)	100 m (330 ft)
ACS550-x1-038A-4			
ACS550-x1-044A-4	ACS400-IF41-3	100 m (330 ft)	100 m (330 ft)
ACS550-x1-059A-4			
ACS550-x1-072A-4			

Warning! Do not use filters in a floating, or high impedance earthed network.

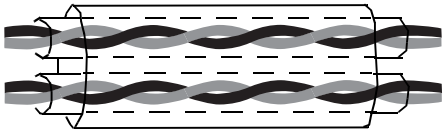
- must have effective screen as described in "Effective Motor Cable Screens" on page 11.
- must be earthed, at the motor end, with an EMC cable gland.The earthing must contact the cable screen all the way around the cable.

Control Cables

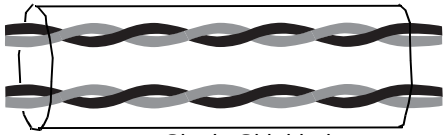
General Recommendations

Use shielded cables, temperature rated at 60 °C (140 °F) or above:

- Control cables must be multi-core cables with a braided copper wire screen.



Double Shielded
Example: JAMAK by Draka NK Cables



Single Shielded
Example: NOMAK by Draka NK Cables

- The screen must be twisted together into a bundle not longer than five times its width and connected to terminal X1-1 (for digital and analog I/O cables) or to either X1-28 or X1-32 (for RS485 cables).

Route control cables to minimize radiation to the cable:

- Route as far away as possible from the input power and motor cables (at least 20 cm (8 in)).
- Where control cables must cross power cables make sure they are at an angle as near 90° as possible.
- Stay at least 20 cm (8 in) from the sides of the drive.

Use care in mixing signal types on the same cable:

- Do not mix analog and digital input signals on the same cable.
- Run relay-controlled signals as twisted pairs (especially if voltage > 48 V). Relay-controlled signals using less than 48 V can be run in the same cables as digital input signals.

Note! Never mix 24 VDC and 115/230 VAC signals in the same cable.

Analog Cables

Recommendations for analog signal runs:

- Use double shielded, twisted pair cable
- Use one individually shielded pair for each signal.
- Do not use a common return for different analog signals.

Digital Cables

Recommendations for digital signal runs:

- A double shielded cable is the best alternative, but single shielded twisted multi-pair cable is also usable.

Control Panel Cable

If the control panel is connected to the drive with a cable, use only Category 5 Patch ethernet cable.

Installing the Drive

Warning! Before installing the ACS550, ensure the input power supply to the drive is off.

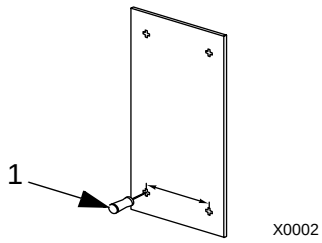
Unpack the Drive

1. Unpack the drive.
2. Check for any damage and notify the shipper immediately if damaged components are found.
3. Check the contents against the order and the shipping label to verify that all parts have been received.

Prepare the Mounting Location

The ACS550 should only be mounted where all of the requirements defined in "Preparing for Installation" on page 7 are met.

1. Mark the position of the mounting holes.
2. Drill the holes.

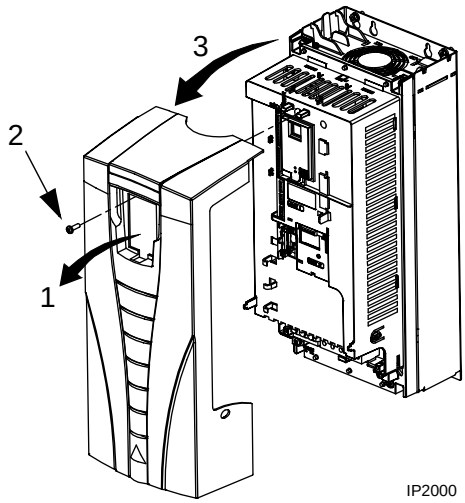


Note! Frame sizes R3 and R4 have four holes along the top. Use only two. If possible, use the two outside holes (to allow room to remove the fan for maintenance).

Note! ACS400 drives can be replaced using the original mounting holes. For R1 and R2 frame sizes, the mounting holes are identical. For R3 and R4 frame sizes, the inside mounting holes on the top of ACS550 drives match ACS400 mounts.

Remove Front Cover

1. Remove the control panel, if attached.
2. Loosen the captive screw at the top.
3. Pull near the top to remove the cover.

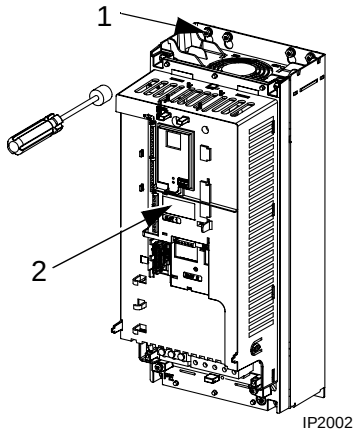


Mount the Drive

1. Position the ACS550 onto the mounting screws or bolts and securely tighten in all four corners.

   Note! Lift the ACS550 by its metal chassis.

2. Non-English speaking locations: Add a warning sticker in the appropriate language over the existing warning on the top of the module.



Install the Wiring

Conduit/Gland Kit

Wiring drives requires a conduit/gland kit with the following items:

- conduit/gland box
- five (5) cable clamps (ACS550-01 only)
- screws
- cover

Overview

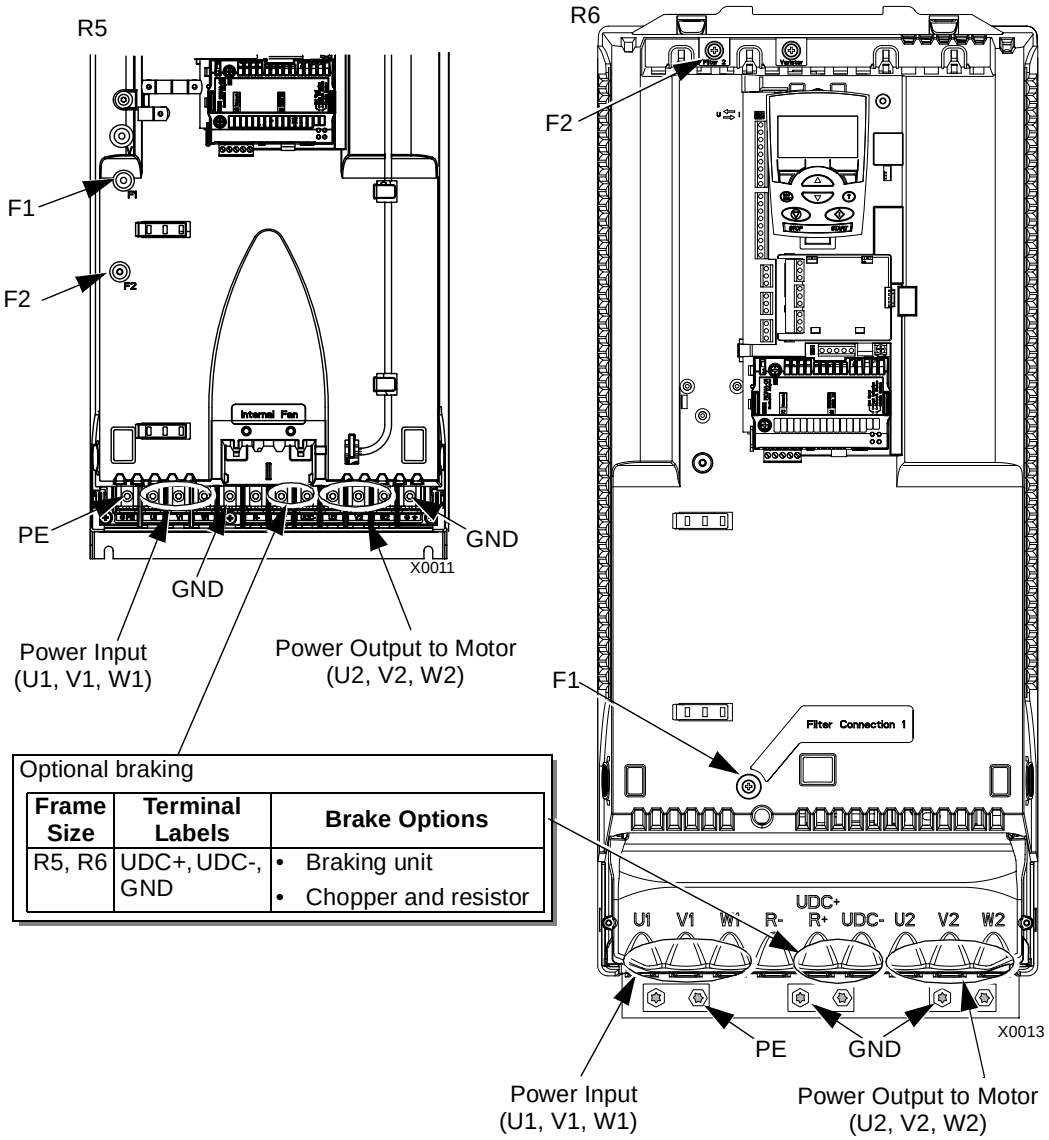
As you install the wiring, observe the following:

- "Connection Diagrams" on page 16 shows the connection points on the drive.
- "Power Connections" on page 20 describes specific instructions for wiring the power. Use in combination with the appropriate general procedure.
- "Control Connections" on page 20 describes specific instructions for wiring the control. Use in combination with the appropriate general procedure.
- "Optional Braking" on page 20, and "Floating Networks" on page 20 describe specific instructions for use as appropriate.
- "Cable Terminals" on page 129 list the recommended tightening torques.
- Where applicable, observe EMC recommendations. For example, properly ground the wire screen cable shields.

Connection Diagrams

The layout of connection terminals is similar for all frame sizes (R1...R6). The only significant layout difference is in the power and ground terminals for frame sizes R5 and R6. The following diagrams show:

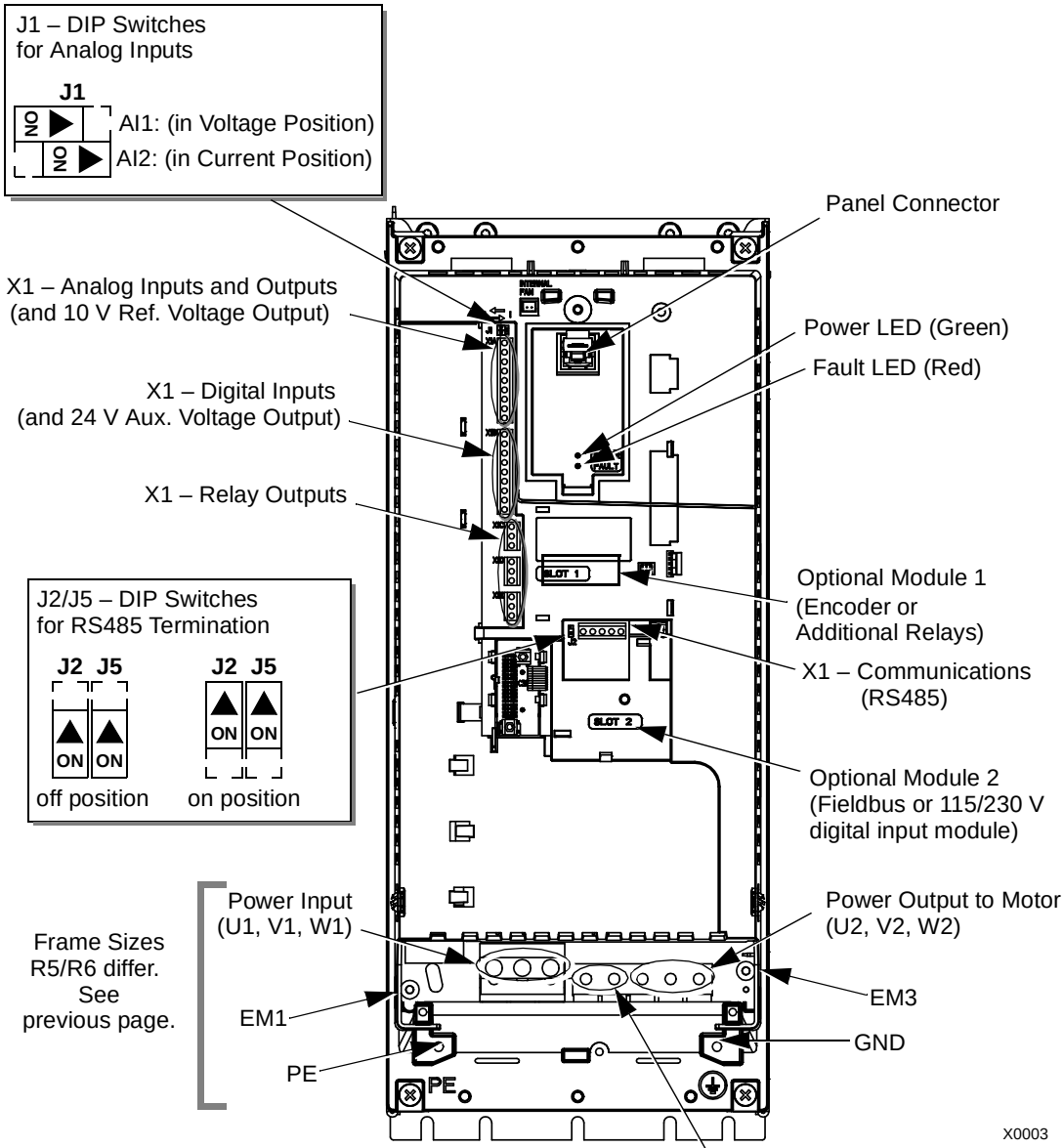
- Power and ground terminal layout for frame sizes R5 and R6.
- Terminal layout for frame size R3, which, in general, applies to all frame sizes except as noted above.



Optional braking

Frame Size	Terminal Labels	Brake Options
R5, R6	UDC+, UDC-, GND	• Braking unit • Chopper and resistor

Warning! For floating networks remove screws at F1 and F2.



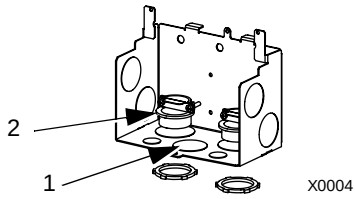
Frame Size	Terminal Labels	Brake Options
R1, R2	BRK+, BRK-	Brake resistor
R3, R4	UDC+, UDC-	• Braking unit • Resistor and chopper

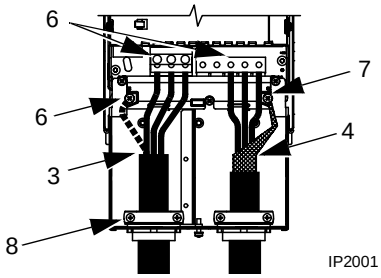
Diagram shows the R3 frame. Other frames have similar layouts.

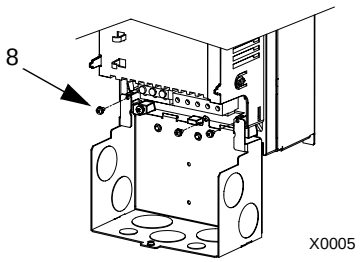
Warning! For floating networks remove screws at EM1 and EM3.

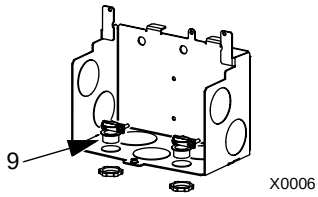
Wiring with Cables

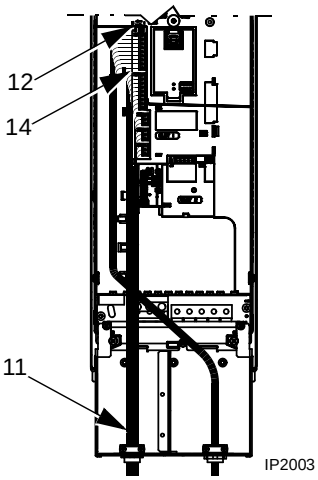
1. Open the appropriate knockouts in the conduit/gland box. (See "Conduit/Gland Kit" above.)
2. Install the cable clamps for the power/motor cables.
3. On the input power cable, strip the sheathing back far enough to route individual wires.
4. On the motor cable, strip the sheathing back far enough to expose the copper wire screen so that the screen can be twisted into a pig-tail. Keep the short pig-tail short to minimize noise radiation.
5. Route both cables through the clamps.
6. Strip and connect the power/motor wires, and the power ground wire to the drive terminals. See "Power Connections" on page 20.
7. Connect the pig-tail created from the motor cable screen.
8. Install conduit/gland box and tighten the cable clamps.
9. Install the cable clamp(s) for the control cable(s). (Power/motor cables and clamps not shown in figure.)
10. Strip control cable sheathing and twist the copper screen into a pig-tail.
11. Route control cable(s) through clamp(s) and tighten clamp(s).
12. Connect the ground screen pig-tail for digital and analog I/O cables at X1-1.
13. Connect the ground screen pig-tail for RS485 cables at X1-28 or X1-32.
14. Strip and connect the individual control wires to the drive terminals. See "Control Connections" on page 20.
15. Install the conduit/gland box cover (1 screw).





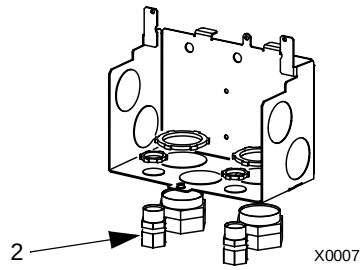




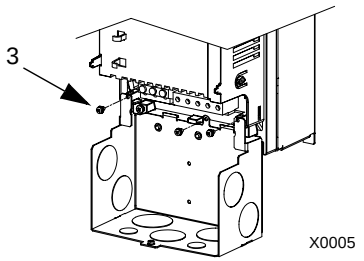


Wiring with Conduit

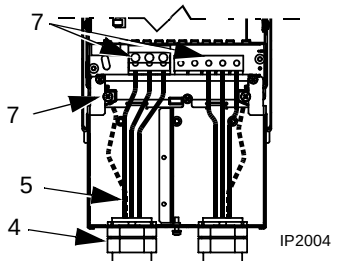
1. Open the appropriate knockouts in the conduit/gland box. (See "Conduit/Gland Kit" above.)
2. Install thin-wall conduit clamps (not supplied).



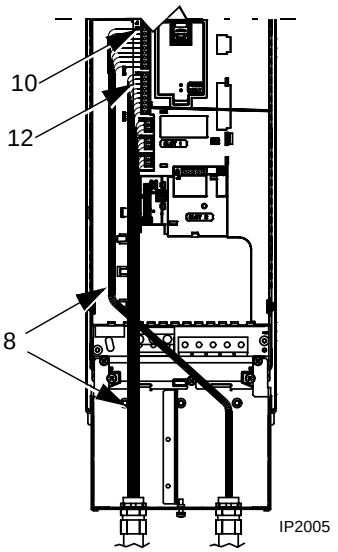
3. Install conduit/gland box.
4. Connect conduit runs to box.



5. Route input power and motor wiring through conduits.
6. Strip wires.
7. Connect power, motor, and ground wires to the drive terminals. See "Power Connections" on page 20.



8. Route the control cable through the conduit.
9. Strip the control cable sheathing and twist the copper screen into a pig-tail.
10. Connect the ground screen pig-tail for digital and analog I/O cables at X1-1.
11. Connect the ground screen pig-tail for RS485 cables at X1-28 or X1-32.
12. Strip and connect the individual control wires to the drive terminals. See "Control Connections" on page 20.
13. Install the conduit/gland box cover (1 screw).



Power Connections

Warning! Ensure the motor is compatible for use with the ACS550. The ACS550 must be installed by a competent person in accordance with the considerations defined in "Preparing for Installation" on page 7. If in doubt, contact your local ABB sales or service office.

- Refer to the following table to complete the power connections. If appropriate, also perform the instructions for the braking and floating networks.

Terminal	Frame Size	Description	Note
U1, V1, W1*	R1…R6	3-phase power supply input	"Input Power (Mains) Connection" on page 130.
PE	R1…R6	Protective Ground	Follow local rules for cable size.
U2, V2, W2	R1…R6	Power output to motor	"Motor Connection" on page 130.

* For single phase supply voltage connect power at U1 and W1.

Optional Braking

- For drives with the braking accessory, install one of the following, depending on the drive's frame size:

Frame Size	Terminal	Description	Braking Accessory
R1, R2	BRK+, BRK-	Braking resistor	Braking resistor.
R3, R4, R5, R6	UDC+, UDC-	DC bus	• Braking unit or • Chopper and resistor

Floating Networks

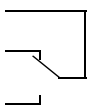
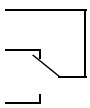
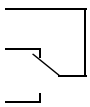
For floating networks (also known as IT, ungrounded, or high impedance networks):

- Disconnect the internal RFI filter by removing both the EM1 and EM3 screws (frame sizes R1…R4, see **17**), or F1 and F2 screws (frame sizes R5…R6, see **16**).
- Where EMC requirements exist, check for excessive emission propagated to neighboring low voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, use a supply transformer with static screening between the primary and secondary windings.
- Do NOT install an external filter, such as one of the kits listed in the filter table on 12. Using an RFI filter grounds the input power through the filter capacitors, which could be dangerous and could damage the unit.

Control Connections

To complete the control connections, use:

- Following tables
- "Application Macros" on page 31
- "Complete Parameter Descriptions" on page 50
- Cable recommendations in "Control Cables" on page 13

	X1		Hardware Description
Analog I/O	1	SCR	Terminal for signal cable screen. (Connected internally to chassis ground.)
	2	AI1	Analog input channel 1, programmable. Default[2] = frequency reference. Resolution 0.1%, accuracy ±1%.
			J1:AI1 OFF: 0…10 V (R_i = 312 kΩ)
			J1:AI1 ON: 0…20 mA (R_i = 100 Ω)
	3	AGND	Analog input circuit common. (Connected internally to chassis gnd. through 1 MΩ)
	4	+10 V	10 V/10 mA reference voltage output for analog input potentiometer, accuracy ±2%.
	5	AI2	Analog input channel 2, programmable. Default[2] = not used. Resolution 0.1%, accuracy ±1%.
			J1:AI2 OFF: 0…10 V (R_i = 312 kΩ)
			J1:AI2 ON: 0…20 mA (R_i = 100 Ω)
	6	AGND	Analog input circuit common. (Connected internally to chassis gnd. through 1 MΩ)
	7	AO1	Analog output, programmable. Default[2] = frequency. 0…20 mA (load < 500 Ω)
	8	AO2	Analog output, programmable. Default[2] = current. 0…20 mA (load < 500 Ω)
	9	AGND	Analog output circuit common (Connected internally to chassis gnd. through 1 MΩ)
Digital Inputs[1]	10	+24V	Auxiliary voltage output 24 VDC / 250 mA (reference to GND). Short circuit protected.
	11	GND	Auxiliary voltage output common. (Connected internally as floating.)
	12	DCOM	Digital input common. To activate a digital input, there must be ≥+10 V (or ≤-10 V) between that input and DCOM. The 24 V may be provided by the ACS550 (X1-10) or by an external 12…24 V source of either polarity.
	13	DI1	Digital input 1, programmable. Default[2] = start/stop.
	14	DI2	Digital input 2, programmable. Default[2] = fwd/rev.
	15	DI3	Digital input 3, programmable. Default[2] = constant speed sel (code).
	16	DI4	Digital input 4, programmable. Default[2] = constant speed sel (code).
	17	DI5	Digital input 5, programmable. Default[2] = ramp pair selection (code).
	18	DI6	Digital input 6, programmable. Default[2] = not used.
Relay Outputs	19	RO1C	 Relay output 1, programmable. Default[2] = Ready Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	20	RO1A	
	21	RO1B	
	22	RO2C	 Relay output 2, programmable. Default[2] = Running Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	23	RO2A	
	24	RO2B	
	25	RO3C	 Relay output 3, programmable. Default[2] = Fault Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	26	RO3A	
	27	RO3B	

[1] Digital input impedance 1.5 kΩ. Maximum voltage for digital inputs is 30 V.

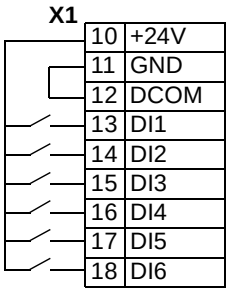
[2] Default values depend on the macro used. Values specified are for the default macro. See "Application Macros" on page 31.

Note! Terminals 3, 6, and 9 are at the same potential.

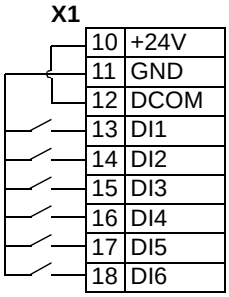
Note! For safety reasons the fault relay signals a "fault" when the ACS550 is powered down.

You can wire the digital input terminals in either a PNP or NPN configuration.

PNP connection (source)



NPN connection (sink)



Communications

Terminals 28...32 are for RS485 modbus communications. Use shielded cables.

Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding earthing terminals.

As always, the grounding wires should not form any closed loops, and all the devices should be earthed to a common ground.

Terminate the RS485 network using 120 Ω resistors at both ends of the network. Use the DIP switch to connect or disconnect the termination resistors. See following diagram and table.

X1	Identification	Hardware Description[1]
28	Screen	RS485 Multidrop application Other Modbus Devices SCR B A GND B A GND SCR 28 SCR 29 B 30 A 31 AGND 32 SCR **RS485 interface** J2 J5 ON ON off position J2 J5 ON ON on position Bus termination
29	B	
30	A	
31	AGND	
32	Screen	

[1] For functional descriptions, see "Application Macros" on page 31, "Complete Parameter Descriptions" on page 50, and communication protocol documentation.

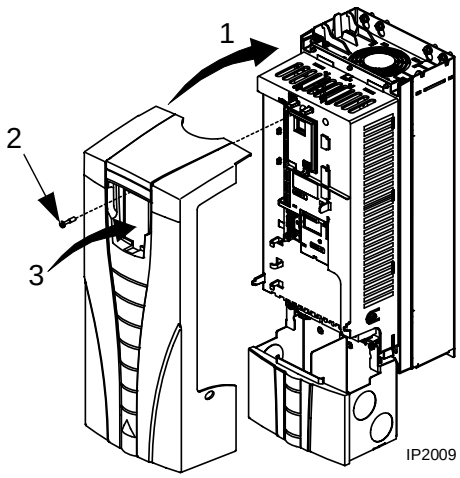
Check Installation

Before applying power, perform the following checks.

✓	Check
	Installation environment conforms to the drive's specifications for ambient conditions.
	The drive is mounted securely.
	Space around the drive meets the drive's specifications for cooling.
	The motor and driven equipment are ready for start.
	For floating networks: The internal RFI filter is disconnected.
	The drive is properly grounded.
	The input power (mains) voltage matches the drive nominal input voltage.
	The input power (mains) connections at U1, V1, and W1 are connected and tightened as specified.
	The input power (mains) fuses are installed.
	The motor connections at U2, V2, and W2 are connected and tightened as specified.
	The motor cable is routed away from other cables.
	NO power factor compensation capacitors are in the motor cable.
	The control connections are connected and tightened as specified.
	NO tools or foreign objects (such as drill shavings) are inside the drive.
	NO alternate power source for the motor (such as a bypass connection) is connected – no voltage is applied to the output of the drive.

Re-install Cover

1. Align the cover and slide it on.
2. Tighten the captive screw.
3. Re-install the control panel.



Apply Power

Always re-install the front cover before turning power on.

Warning! The ACS550 will start up automatically at power up, if the external run command is on.

1. Apply input power.

   When power is applied to the ACS550, the green LED comes on.

Note! Before increasing motor speed, check that the motor is running in the desired direction.

Start-Up

1. Use any, or all of the following options to configure the drive:
   - Use the Start-up Assistant.
     With the Assistant Control Panel, the Start-up Assistant runs automatically at the first power up. See "Start-up Assistant Mode" on page 29 for an overview of the program. For instructions on basic operation of the Assistant Control Panel, see "Controls/Display Overview" on page 26.
   - Select an application macro.
     See "Application Macros" on page 31.
   - Manually select and set individual parameters.
     See "Parameters Mode" on page 29.

Start-Up

Start-up configures the drive. This process sets parameters that define how the drive operates and communicates. Depending on the control and communication requirements, the start-up process may require any or all of the following:

- The Start-up Assistant (requires the Assistant Control Panel) steps you through the default configuration. The Start-up Assistant runs automatically at the first power up, or can be accessed at any time using the main menu.
- Application macros can be selected to define common, alternate system configurations, using the default settings. See "Application Macros" on page 31.
- Additional refinements can be made using the control panel to manually select and set individual parameters. See "Complete Parameter Descriptions" on page 50.

Assistant Control Panel

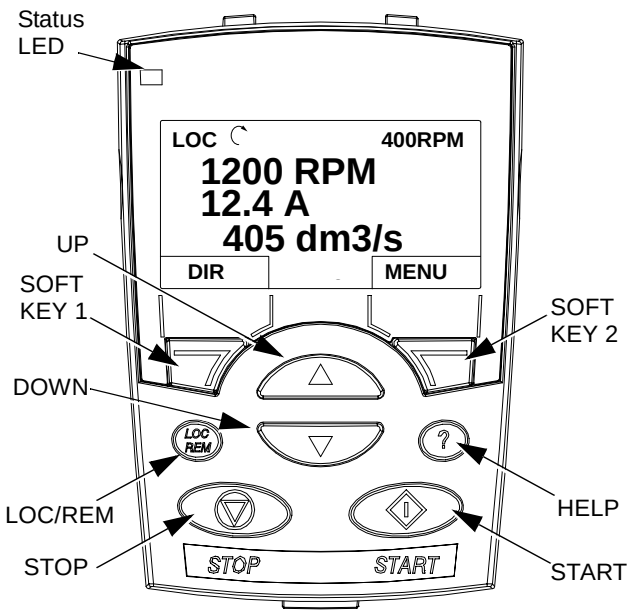
Use a control panel to control the ACS550, to read status data, and to adjust parameters.

- Assistant Control Panel – This panel (described below) includes pre-programmed assistants to automate the most common parameter setups.

Features

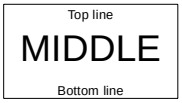
The ACS550 Assistant Control Panel features:

- Alphanumeric control panel with a LCD display
- Language selection for the display
- Drive connection that can be made or detached at any time
- Start-up Assistant to ease drive commissioning
- Copy function for moving parameters to other ACS550 drives
- Backup function for saving parameter set
- Context sensitive help



Controls/Display Overview

The following table summarizes the button functions and displays on the Assistant Control Panel

Item	Description
	Status LED – During normal operation the status LED should be green. See "Diagnostic Displays" On page 119 if the LED is flashing or is red.
	LCD Display – Divided into three main areas: • Top line – variable, depending on the mode of operation. For example, see "Status Information" on page 26. • Middle area – variable, in general, shows parameter values, menus or lists. • Bottom line – shows current function of the two soft keys.
	Soft key 1 – Function varies, and is defined by the text in the lower-left corner of the LCD display.
	Soft key 2 – Function varies, and is defined by the text in the lower-right corner of the LCD display.
	Up – • Scrolls up through a menu or list displayed in the middle of the LCD Display. • Increments a value if a parameter is selected. • Increments the reference if the upper-right corner is highlighted (in reverse video).
	Down – • Scrolls down through a menu or list displayed in the middle of the LCD Display. • Decrements a value if a parameter is selected. • Decrements the reference if the upper-right corner is highlighted (in reverse video).
	Stop – Stops the drive.
	Start – Starts the drive.
	LOC/REM – Press and hold to change between local and remote control of the drive.
	Help – Displays context sensitive information when the button is pressed. The information displayed describes the item currently highlighted in the middle area of the display.

Control mode

Use the control mode to read information on the drive's status and to operate the drive. To reach the control mode, press EXIT until the LCD display shows status information as described below.

Status Information

Top. The top line of the LCD display shows the basic status information of the drive.

- LOC – indicates that the drive control is local, that is, from the control panel.
- REM – indicates that the drive control is remote, such as the basic I/O (X1) or fieldbus.

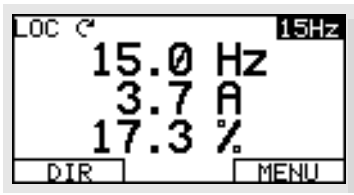
- ↻ – indicates the drive and motor rotation status as follows:

Control Panel Display	Significance
Rotating arrow (clockwise or counter clockwise)	• Drive is running and at setpoint • Shaft direction is forward ↻ or reverse ↺
Rotating arrow blinking	Drive is running but not at setpoint.
Stationary arrow	Drive is stopped.

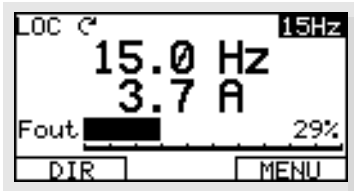
- Upper right – shows the active reference.

Middle. Using parameter Group 34, the middle of the LCD display can be configured to display:

- 3 parameter values
  The default values depend on the parameter 9904 motor control mode value. If 9904 = 1, the display shows parameters 0102 (SPEED), 0104 (CURRENT), 0105 (TORQUE). If 9904 = 3, the display shows 0103 (OUTPUT FREQ), 0104 (CURRENT), 0105 (TORQUE)



- A bar meter rather than one of the parameter values.



Bottom. The bottom of the LCD display shows:

- Lower corners – show the functions currently assigned to the two soft keys.
- Lower middle – displays the current time (if configured to show the time).

Operating the Drive

LOC/REM – The very first time the drive is powered up, it is in the remote control (REM) mode, and is controlled from the Control Terminal Block X1.

To switch to local control (LOC) and control the drive using the control panel, press and hold the LOC REM button until first, LOCAL CONTROL, or later, LOCAL, KEEP RUN, is displayed:

- Release the button while LOCAL CONTROL is displayed to set the panel reference to the current external reference. The drive stops.
- Release the button when LOCAL, KEEP RUN is displayed, to copy the current run/stop status and the reference from the user I/O.

To switch back to remote control (REM) press and hold the LOC REM button until REMOTE CONTROL is displayed.

Start/Stop – To start and stop the drive press the START and STOP buttons.

Shaft direction – To change the shaft direction press DIR (parameter 1003 must be set to 3 (REQUEST)).

Reference – To modify the reference (only possible if the display in the upper right corner is in reverse video) press the UP or DOWN buttons (the reference changes immediately).

The reference can be modified in the local control mode, and can be parameterized (using Group 11: Reference Select) to also allow modification in the remote control mode.

Other Modes

Besides the Control mode, the Assistant Control Panel has:

- Other operating modes that are available through the main menu.
- A fault mode that is triggered by faults. The fault mode includes a diagnostic assistant mode.

Access to Main Menu Modes

To reach the main menu:

- Press EXIT, as necessary, to step back through the menus or lists associated with a particular mode. Continue until you are back to the normal mode.
- Press MENU from the normal mode.

At this point, the middle of the display is a listing of the other modes, and the top-right text says “Main menu”

- Use Up/Down buttons to scroll to the desired mode.
- Press ENTER to enter the mode that is highlighted (reverse video).

Summary of the Modes

The other modes are:

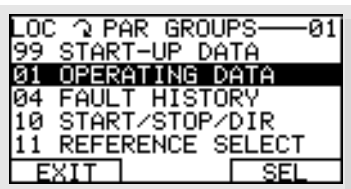
- Parameters – Use this mode to edit parameter values individually. For more information, see "Parameters Mode" on page 29. Access to this mode is from the main menu.
- Start-up Assistant – When the drive is first powered up, the Start-up Assistant asks you questions. Your answers set a few basic parameters. Other assistants are available to support common operations. For more information, see "Start-up Assistant Mode" on page 29. Access to this mode is from the main menu (and is automatic at initial drive power up).
- Changed parameters – This mode simply displays a list of the parameters that have been changed from the default values set at the factory. Access to this mode is from the main menu.
- Fault logger – This mode displays a fault history list. You can select a fault and display critical drive status information associated with the fault.
- Drive parameter backup – The backup can be complete or partial. Use the complete backup, for example, when replacing a drive with a new one. Use the partial backup, for example, to copy parameters from one drive to another (the drives do not need to be the same size). Access to this mode is from the main menu.
  - Upload stores the parameters to the panel.

– Download restores the parameters into the drive.
– A partial restore option excludes the following parameters from the backup: 9905…9909, 1605, 1607, 5201, and all Group 51 parameters.

Parameters Mode

Use the Parameters mode to manually set parameters:

- Select PARAMETERS in the Main Menu.
- Press the UP/DOWN buttons to highlight the appropriate parameter group, then press SEL.



- Press the UP/DOWN buttons to highlight the appropriate parameter in a group.

NOTE! The current parameter value appears below the highlighted parameter.

- Press EDIT.
- Press the UP/DOWN buttons to increment the parameter value.

Note! To view the parameter default value in the set mode, press the UP/DOWN buttons simultaneously.

- Press SAVE to store the modified value or press CANCEL to leave the set mode. Any modifications not saved are cancelled.
- Press EXIT to return to the listing of parameter groups, and again to return to the main menu.

Start-up Assistant Mode

The Start-up Assistant guides you through the basic programming of a new drive. (You should understand basic control panel operation as described in "Controls/ Display Overview" on page 26.) The assistant also checks the values entered to prevent entries that are out of range. At the first start, the drive automatically suggests entering the first task, Language Select.

The Start-up Assistant is divided into tasks. You may activate the tasks one after the other, as the Start-up Assistant suggests, or independently. (You are not required to use the assistant, you may use instead, the parameter mode to set the drive parameters.)

The order of the tasks presented by the Start-up Assistant depends on your entries. The task list in the following table is typical.

Task name	Description
Language Select	Selects the language used in control panel displays
Motor Set-up	Enters motor data and motor identification
Application	Selects an application macro
Option Modules	Activates optional modules, if any, mounted on the drive.
Speed Control EXT1	• Selects the source for the speed reference • Sets the reference limits • Sets the speed (or frequency) limits • Sets acceleration and deceleration times • Sets up the brake chopper if activated
Speed Control EXT2	• Sets the source for the speed reference • Sets the reference limits
Torque Control	• Selects the source for the torque reference • Sets the reference limits • Sets the torque ramp up and ramp down times
PID Control	• Selects the source for the process reference • Sets the reference limits • Sets the speed (reference) limits • Sets the source and limits for the process actual value
Start/Stop Control	• Selects either EXT1 or EXT2 • Defines the direction control • Defines the start and stop modes • Selects the use of Run Enable signal
Protections	Sets the torque and current limits
Output Signals	Selects the signals indicated through the relay outputs RO1, RO2, RO3 and optional relay output's (if installed). Selects the signals indicated through the analog outputs AO1 and AO2. Sets the minimum, maximum, scaling and inversion values.

Application Macros

Macros change a group of parameters to new, predefined values. Use macros to minimize the need for manual editing of parameters. Selecting a macro sets all other parameters to their default values, except:

- Group 99: Start-up Data parameters
- the PARAMETER LOCK 1602
- the PARAM SAVE 1607
- Groups 50…52 serial communication parameters

After selecting a macro, additional parameter changes can be made manually using the control panel.

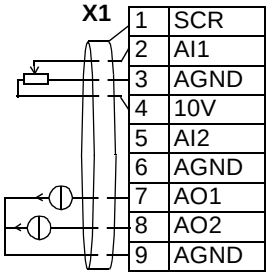
Application macros are predefined parameter sets enabled by setting the value for parameter 9902 APPLIC MACRO. By default, 1, ABB Standard, is the enabled macro.

The following sections describe each of the application macros and provide a connection example for each macro.

Application Macro: ABB Standard (Default)

This macro provides a general purpose, 2-wire I/O configuration, with three (3) constant speeds. This is the default macro. Parameter values are the default values defined in the "Complete Parameter List for ACS550" on page 40.

Connection example:



X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External frequency reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 VDC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Output frequency:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 VDC
11	GND	Common for DI return signals.
12	DCOM1	Digital input common for all
13	DI1	**Start/Stop:** Activate to start
14	DI2	**Fwd/Rev:** Activate to reverse rotation direction
15	DI3	**Constant speed selection**[2]
16	DI4	**Constant speed selection**[2]
17	DI5	**Ramp pair selection:** Activate to select 2nd acc/dec ramp pair.
18	DI6	Not used
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault** =>25 connected to 26
26	RO3A	
27	RO3B	

Note 1. The external reference is used as a speed reference, if the vector control mode is selected,

Note 2. Code:
0 = open, 1 = connected

DI3	DI4	Output
0	0	Reference through AI1
1	0	CONSTANT SPEED 1 (1202)
0	1	CONSTANT SPEED 2 (1203)
1	1	CONSTANT SPEED 3 (1204)

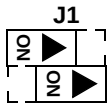
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2)
- Constant speed selection (DI3,4)
- Ramp pair (1 of 2) selection (DI5)

Output signals

- Analog output AO1: Frequency
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting



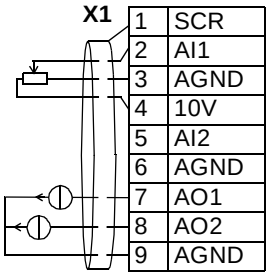
AI1: 0…10 V
AI2: 0(4)…20 mA

Application Macro: 3-wire

This macro is used when the drive is controlled using momentary push-buttons, and provides three (3) constant speeds. To enable, set the value of parameter 9902 to 2 (3-WIRE).

Note! When the stop input (DI2) is deactivated (no input), the control panel start/stop buttons are disabled.

Connection example:



X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External speed reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 VDC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 VDC
11	GND	Common for DI return signals.
12	DCOM1	Digital input common for all
13	DI1	**Start:** Momentary activation with DI2 activated starts the drive.
14	DI2	**Stop:** Momentary deactivation stops the drive.
15	DI3	**Fwd/Rev:** Activation reverses rotation direction.
16	DI4	**Constant speed selection**[1]
17	DI5	**Constant speed selection**[1]
18	DI6	Not used
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault** =>25 connected to 26
26	RO3A	
27	RO3B	

Note 1. Code:
0 = open, 1 = connected

DI4	DI5	Output
0	0	Reference through AI1
1	0	CONSTANT SPEED 1 (1202)
0	1	CONSTANT SPEED 2 (1203)
1	1	CONSTANT SPEED 3 (1204)

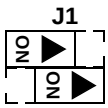
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2,3)
- Constant speed selection (DI4,5)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting

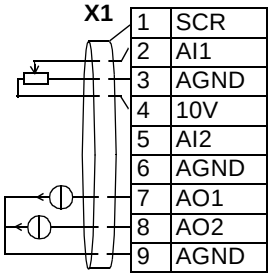


AI1: 0…10 V
AI2: 0(4)…20 mA

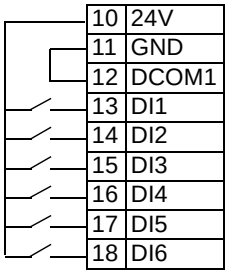
Application Macro: Alternate

This macro provides an I/O configuration adopted to a sequence of DI control signals used when alternating the rotation direction of the drive.To enable, set the value of parameter 9902 to 3 (ALTERNATE).

Connection example:



1	SCR	Signal cable shield (screen)
2	AI1	**External speed reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 VDC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common



10	24V	Auxiliary voltage output +24 VDC
11	GND	Common for DI return signals.
12	DCOM1	Digital input common for all
13	DI1	**Start fwd:** If DI1 state is the same as DI2, drive **stops**
14	DI2	**Start reverse**
15	DI3	**Constant speed selection**[1]
16	DI4	**Constant speed selection**[1]
17	DI5	**Ramp pair selection:** Activation selects 2nd acc/dec ramp pair.
18	DI6	**Run enable:** Deactivation always stops the drive

19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault** =>25 connected to 26
26	RO3A	
27	RO3B	

Note 1. Code:
0 = open, 1 = connected

DI4	DI5	Output
0	0	Reference through AI1
1	0	CONSTANT SPEED 1 (1202)
0	1	CONSTANT SPEED 2 (1203)
1	1	CONSTANT SPEED 3 (1204)

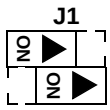
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2)
- Constant speed selection (DI3,4)
- Ramp pair 1/2 selection (DI5)
- Run enable (DI6)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting

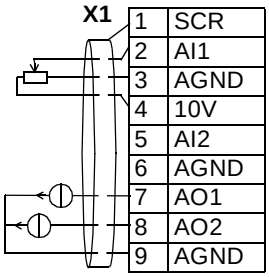


AI1: 0…10 V
AI2: 0(4)…20 mA

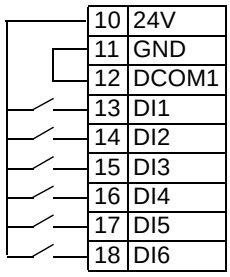
Application Macro: Motor Potentiometer

This macro provides a cost-effective interface for PLCs that vary the speed of the drive using only digital signals. To enable, set the value of parameter 9902 to 4 (MOTOR POT).

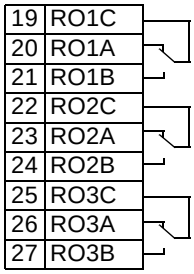
Connection example:



Signal cable shield (screen)
External speed reference 1: 0…10 V
Analog input circuit common
Reference voltage 10 VDC
Not used
Analog input circuit common
Motor output speed: 0…20 mA
Output current: 0…20 mA
Analog output circuit common



Auxiliary voltage output +24 VDC
Common for DI return signals.
Digital input common for all
Start/stop: Activation starts the drive.
Forward/reverse: Activation reverses rotation direction.
Reference up: Activation increases the reference[1].
Reference down: Activation decreases the reference[1].
Constant speed 1: 1202
Run enable: Deactivation always stops the drive.



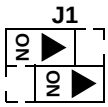
Relay output 1, programmable
Default operation:
Ready =>19 connected to 21
Relay output 2, programmable
Default operation:
Running =>22 connected to 24
Relay output 3, programmable
Default operation:
Fault =>25 connected to 26

Note 1. For DI3 and DI4:
- If both are active or inactive the speed reference is unchanged.
- The existing speed reference is stored during stop or power down.
- The external speed reference (AI1) is not used (except as the start point at the initial power up).

Input signals
- Analog reference (AI1)
- Start, stop and direction (DI1,2)
- Reference up/down (DI3,4)
- Constant speed selection (DI5)
- Run enable (DI6)

Output signals
- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting



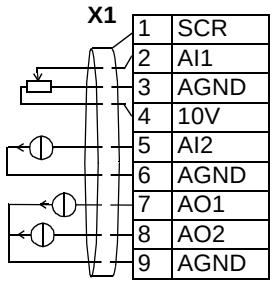
AI1: 0…10 V
AI2: 0(4)…20 mA

Application macro: Hand-Auto

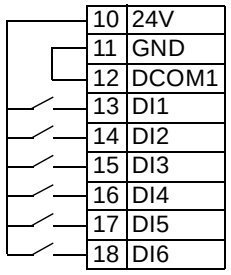
This macro provides an I/O configuration that is typically used in HVAC applications. To enable, set the value of parameter 9902 to 5 (HAND/AUTO).

Note! Parameter 2107 START INHIBIT must remain in the default setting, 0 (OFF).

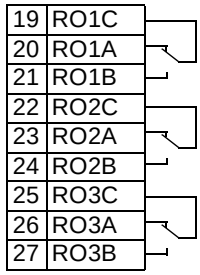
Connection example:



Signal cable shield (screen)
External reference 1: 0…10 V **(Hand Control)**
Analog input circuit common
Reference voltage 10 VDC
External reference 2: 0…20 mA **(Auto Control)**
Analog input circuit common
Motor output speed: 0…20 mA
Output current: 0…20 mA
Analog output circuit common



Auxiliary voltage output +24 VDC
Common for DI return signals.
Digital input common for all
Start/Stop (Hand): Activation starts the drive.
Forward/Reverse (Hand): Activation reverses rotation direction.
EXT1/EXT2 Selection: Activation selects auto control
Run enable: Deactivation always stops the drive
Forward/Reverse (Auto): Activation reverses rotation direction.
Start/Stop (Auto): Activation starts the drive.



Relay output 1, programmable
Default operation:
Ready =>19 connected to 21
Relay output 2, programmable
Default operation:
Running =>22 connected to 24
Relay output 3, programmable
Default operation:
Fault =>25 connected to 26

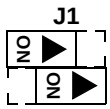
Input signals

- Two analog references (AI1, 2)
- Start/stop – hand/auto (DI1, 6)
- Direction – hand/auto (DI2, 5)
- Control location selection (DI3)
- Run enable (DI4)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting



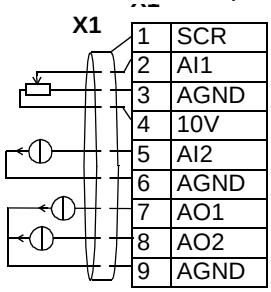
AI1: 0…10 V
AI2: 0(4)…20 mA

Application Macro: PID Control

This macro provides parameter settings for closed-loop control systems such as pressure control, flow control, etc. To enable, set the value of parameter 9902 to 6 (PID CTRL).

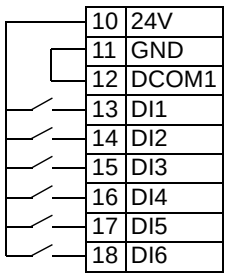
Note! Parameter 2107 START INHIBIT must remain in the default setting, 0 (OFF).

Connection example:

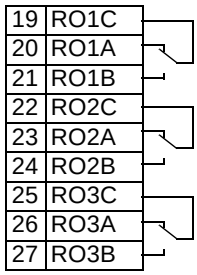


X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External ref. 1 (Manual) or Ext ref. 2 (PID):** 0…10 V[1]
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 VDC
5	AI2	**Actual signal (PID):** 0…20 mA
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common

Note 1.
Manual: 0…10V => speed reference
PID: 0…10V => 0…100% PID setpoint



10	24V	Auxiliary voltage output +24 VDC
11	GND	Common for DI return signals.
12	DCOM1	Digital input common for all
13	DI1	**Start/Stop (Hand):** Activation starts the drive.
14	DI2	**EXT1/EXT2 selection:** Activation selects PID control.
15	DI3	**Constant speed selection 1:** (Not used in PID control)[2]
16	DI4	**Constant speed selection 2:** (Not used in PID control)[2]
17	DI5	**Run enable:** Deactivation always stops the drive
18	DI6	**Start/Stop (PID):** Activation starts the drive.



19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault** =>25 connected to 26
26	RO3A	
27	RO3B	

Note 2. Code:
0 = open, 1 = connected

DI3	DI4	Output
0	0	Reference through AI1
1	0	CONSTANT SPEED 1 (1202)
0	1	CONSTANT SPEED 2 (1203)
1	1	CONSTANT SPEED 3 (1204)

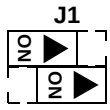
Input signals

- Analog reference (AI1)
- Actual value (AI2)
- Start/stop – hand/PID (DI1, 6)
- EXT1/EXT2 selection (DI2)
- Constant speed selection (DI3, 4)
- Run enable (DI5)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting



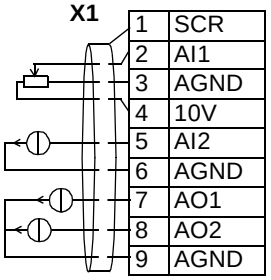
AI1: 0…10 V
AI2: 0(4)…20 mA

Application Macro: PFC

This macro provides parameter settings for pump and fan control (PFC) applications. To enable, set the value of parameter 9902 to 7 (PFC CONTROL).

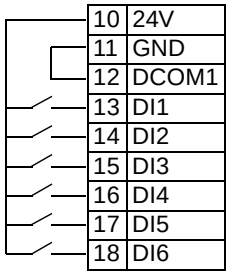
Note! Parameter 2107 START INHIBIT must remain in the default setting, 0 (OFF).

Connection example:

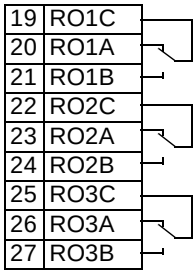


Signal cable shield (screen)
External ref. 1 (Manual) or Ext ref. 2 (PID/PFC): 0…10 V[1]
Analog input circuit common
Reference voltage 10 VDC
Actual signal (PID): 0…20 mA
Analog input circuit common
Output frequency: 0…20 mA
Actual 1 (PI controller actual value): 0(4)…20 mA
Analog output circuit common

Note 1.
Manual: 0…10V => 0…50 Hz
PID/PFC: 0…10V => 0…100%
PID setpoint



Auxiliary voltage output +24 VDC
Common for DI return signals.
Digital input common for all
Start/Stop (Manual): Activation starts the drive.
Run enable: Deactivation always stops the drive
EXT1/EXT2 selection: Activation selects PID control.
Interlock: Deactivation always stops the drive.
Interlock: Deactivation stops constant speed motor.
Start/Stop (PFC): Activation starts the drive.



Relay output 1, programmable
Default operation:
Fault =>19 connected to 20
Relay output 2, programmable
Default operation:
Speed regulated motor switched on =>22 connected to 24
Relay output 3, programmable
Default operation:
Auxiliary motor switched on=>25 connected to 27

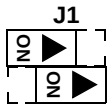
Input signals

- Analog ref. and actual (AI1, 2)
- Start/stop – manual/PFC (DI1, 6)
- Run enable (DI2)
- EXT1/EXT2 selection (DI3)
- Interlock (DI4, 5)

Output signals

- Analog output AO1: Frequency
- Analog output AO2: Actual 1
- Relay output 1: Fault
- Relay output 2: Speed reg. ON
- Relay output 3: Aux. motor ON

Jumper Setting

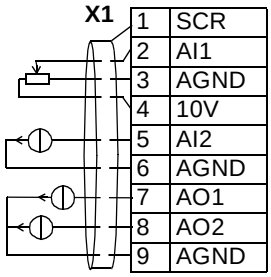


AI1: 0…10 V
AI2: 0(4)…20 mA

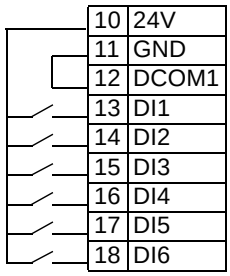
Application Macro: Torque Control

This macro provides parameter settings for applications that require torque control of the motor. Control can also be switched to speed control. To enable, set the value of parameter 9902 to 8 (TORQUE CONTROL).

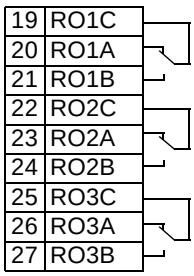
Connection example:



Signal cable shield (screen)
External speed reference 1: 0…10 V
Analog input circuit common
Reference voltage 10 VDC
External torque reference: 4…20 mA
Analog input circuit common
Motor output speed: 0…20 mA
Output current: 0…20 mA
Analog output circuit common



Auxiliary voltage output +24 VDC
Common for DI return signals.
Digital input common for all
Start/stop: Activation starts the drive.
Forward/reverse: Activation reverses direction.[1]
Speed/torque control: Activation selects torque control.
Constant speed 1: 1202
Ramp pair selection: Activate to select 2nd acc/dec ramp pair.
Run enable: Deactivation always stops the drive.



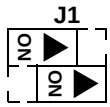
Relay output 1, programmable
Default operation:
Ready =>19 connected to 21
Relay output 2, programmable
Default operation:
Running =>22 connected to 24
Relay output 3, programmable
Default operation:
Fault =>25 connected to 26

Note 1.
- Reverses rotation direction in speed control.
- Reverses torque direction in torque control.

Input signals
- Two analog references (AI1, 2)
- Start/stop and direction (DI1, 2)
- Speed/torque control (DI3)
- Constant speed selection (DI4)
- Ramp pair 1/2 selection (DI5)
- Run enable (DI6)

Output signals
- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault

Jumper Setting



AI1: 0…10 V
AI2: 0(4)…20 mA

Complete Parameter List for ACS550

The following table lists all parameters. Header abbreviations used in the table are:

- S = Parameters can be modified only when the drive is stopped.
- I_{hd} = Heavy Duty Current
- P_{hd} = Heavy Duty Power
- V_{dN} = Drives Nominal Voltage

Code	Name	Range	Resolution	Default	User	S
Group 99: Start-Up Data						
9902	APPLIC MACRO	1…12	1	0		✓
9904	MOTOR CTRL MODE	1=speed, 2=torque, 3=scalar	1	3		✓
9905	MOTOR NOM VOLT	115…345 V	1 V	230 V		✓
		200…600 V / US: 230…690 V	1 V	400 V / US: 460 V		✓
9906	MOTOR NOM CURR	0.2*I_{hd}…2.0*I_{hd}	0.1 A	1.0*I_{hd}		✓
9907	MOTOR NOM FREQ	10.0…500 Hz	0.1 Hz	50 Hz / US: 60 Hz		✓
9908	MOTOR NOM SPEED	50…18000 rpm	1 rpm	1440 rpm / US: 1750 rpm		✓
9909	MOTOR NOM POWER	0.2…2.0*P_{hd}	0.1 kW / US: 0.1 HP	1.0 * P_{hd}		✓
Group 01: Operating Data						
0102	SPEED	0…30000 rpm	1 rpm	-		
0103	OUTPUT FREQ	0.0…500.0 Hz	0.1 Hz	-		
0104	CURRENT	0…2.0*I_{hd}	0.1 A	-		
0105	TORQUE	-200…200%	0.1%	-		
0106	POWER	-2.0…2.0*P_{hd}	0.1 kW	-		
0107	DC BUS VOLTAGE	0…2.5*V_{dN}	1 V	-		
0109	OUTPUT VOLTAGE	0…2.0*V_{dN}	1 V	-		
0110	DRIVE TEMP	0…150 °C	0.1 °C	-		
0111	EXTERNAL REF 1	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	-		
0112	EXTERNAL REF 2	0…100% (0…600% for torque)	0.1%	-		
0113	CTRL LOCATION	0 = local, 1 = ext1, 2 = ext2	1	-		
0114	RUN TIME (R)	0…9999 h	1 h	0 h		
0115	KWH COUNTER (R)	0…9999 kWh	1 kWh	-		
0116	APPL BLK OUTPUT	0…100% (0…600% for torque)	0.1%	-		
0118	DI 1-3 STATUS	000…111 (0…7 decimal)	1	-		
0119	DI 4-6 STATUS	000…111 (0…7 decimal)	1	-		
0120	AI1	0…100%	0.1%	-		
0121	AI2	0…100%	0.1%	-		
0122	RO 1-3 STATUS	000…111 (0…7 decimal)	1	-		
0123	RO 4-6 STATUS	000…111 (0…7 decimal)	1	-		
0124	AO1	0…20 mA	0.1 mA	-		
0125	AO2	0…20 mA	0.1 mA	-		
0126	PID 1 OUTPUT	-1000…1000%	0.1%	-		

Code	Name	Range	Resolution	Default	User	S
0127	PID 2 OUTPUT	-100…100%	0.1%	-		
0128	PID 1 SETPNT	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0129	PID 2 SETPNT	Unit and scale defined by par. 4206 and 4207				
0130	PID 1 FBK	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0131	PID 2 FBK	Unit and scale defined by par. 4206 and 4207	-	-		
0132	PID 1 DEVIATION	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0133	PID 2 DEVIATION	Unit and scale defined by par. 4206 and 4207	-	-		
0134	COMM RO WORD	0…65535	1	0		
0135	COMM VALUE 1	-32768…+32767	1	0		
0136	COMM VALUE 2	-32768…+32767	1	0		
0137	PROCESS VAR 1	-	1			
0138	PROCESS VAR 2	-	1			
0139	PROCESS VAR 3	-	1			
0140	RUN TIME	0…499.99 kh	0.01 kh	0 kh		
0141	MWH COUNTER	0…9999 MWh	1 MWh	-		
0142	REVOLUTION CNTR					
0143	DRIVE ON TIME (HI)	Days	1 day	0		
0144	DRIVE ON TIME (LO)	hh.mm.ss	1 = 2s	0		
0145	MOTOR TEMP	-10...200 °C/ 0...5000 Ohm	1	0		
Group 03: Actual Signals						
0301	FB CMD WORD 1	-	-	-		
0302	FB CMD WORD 2	-	-	-		
0303	FB STS WORD 1	-	-	-		
0304	FB STS WORD 2	-	1	0		
0305	FAULT WORD 1	-	1	0		
0306	FAULT WORD 2	-	1	0		
0307	FAULT WORD 3	-	1	0		
Group 04: Fault History						
0401	LAST FAULT	fault codes (panel displays as text)	1	0		
0402	FAULT TIME 1	Date dd.mm.yy / power-on time in days	1	0		
0403	FAULT TIME 2	Time hh.mm.ss	2 s	0		
0404	SPEED AT FLT	-	1 rpm	0		
0405	FREQ AT FLT	-	0.1 Hz	0		
0406	VOLTAGE AT FLT	-	0.1 V	0		
0407	CURRENT AT FLT	-	0.1 A	0		
0408	TORQUE AT FLT	-	0.1%	0		
0409	STATUS AT FLT	-	1	0		
0410	DI1-3 AT FLT	000…111 (0…7 decimal)	1	0		
0411	DI4-6 AT FLT	000…111 (0…7 decimal)	1	0		

Code	Name	Range	Resolution	Default	User	S
0412	PREVIOUS FAULT 1	as Par. 0401	1	0		
0413	PREVIOUS FAULT 2	as Par. 0401	1	0		
Group 10: Start/Stop/Dir						
1001	EXT1 COMMANDS	0…10	1	2		✓
1002	EXT2 COMMANDS	0…10	1	0		✓
1003	DIRECTION	1…3	1	3		✓
Group 11: Reference Select						
1101	KEYPAD REF SEL	1…2	1	1		✓
1102	EXT1/EXT2 SEL	0…8, -1…-6	1	0		✓
1103	REF1 SELECT	0…17	1	1		✓
1104	REF1 MIN	0…500 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0 Hz / 0 rpm		
1105	REF1 MAX	0…500 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	50 Hz / 1500 rpm US: 60 Hz / 1800 rpm		
1106	REF2 SELECT	0…19	1	2		✓
1107	REF2 MIN	0…100% (0…600% for torque)	0.1%	0%		
1108	REF2 MAX	0…100% (0…600% for torque)	0.1%	100%		
Group 12: Constant Speeds						
1201	CONST SPEED SEL	0…14, -1…-14	1	9		✓
1202	CONST SPEED 1	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	300 rpm / 5 Hz US: 360 rpm / 6 Hz		
1203	CONST SPEED 2	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	600 rpm / 10 Hz US: 720 rpm / 12 Hz		
1204	CONST SPEED 3	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	900 rpm / 15 Hz US: 1080 rpm / 18 Hz		
1205	CONST SPEED 4	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	1200 rpm /20 Hz US: 1440 rpm / 24 Hz		
1206	CONST SPEED 5	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	1500 rpm / 25 Hz US: 1800 rpm / 30 Hz		
1207	CONST SPEED 6	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	2400 rpm / 40 Hz US: 2880 rpm / 48 Hz		
1208	CONST SPEED 7	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	3000 rpm / 50 Hz US: 3600 rpm / 60 Hz		
Group 13: Analogue Inputs						
1301	MINIMUM AI1	0…100%	0.1%	0%		
1302	MAXIMUM AI1	0…100%	0.1%	100%		
1303	FILTER AI1	0…10 s	0.1 s	0.1 s		
1304	MINIMUM AI2	0…100%	0.1%	0%		
1305	MAXIMUM AI2	0…100%	0.1%	100%		
1306	FILTER AI2	0…10 s	0.1 s	0.1 s		
Group 14: Relay Outputs						
1401	RELAY OUTPUT 1	0…36	1	1		
1402	RELAY OUTPUT 2	0…36	1	2		
1403	RELAY OUTPUT 3	0…36	1	3		
1404	RO 1 ON DELAY	0…3600 s	0.1 s	0 s		
1405	RO 1 OFF DELAY	0…3600 s	0.1 s	0 s		
1406	RO 2 ON DELAY	0…3600 s	0.1 s	0 s		

Code	Name	Range	Resolution	Default	User	S
1407	RO 2 OFF DELAY	0…3600 s	0.1 s	0 s		
1408	RO 3 ON DELAY	0…3600 s	0.1 s	0 s		
1409	RO 3 OFF DELAY	0…3600 s	0.1 s	0 s		
1410	RELAY OUTPUT 4	0…36	1	0		
1411	RELAY OUTPUT 5	0…36	1	0		
1412	RELAY OUTPUT 6	0…36	1	0		
1413	RO 4 ON DELAY	0…3600 s	0.1 s	0 s		
1414	RO 4 OFF DELAY	0…3600 s	0.1 s	0 s		
1415	RO 5 ON DELAY	0…3600 s	0.1 s	0 s		
1416	RO 5 OFF DELAY	0…3600 s	0.1 s	0 s		
1417	RO 6 ON DELAY	0…3600 s	0.1 s	0 s		
1418	RO 6 OFF DELAY	0…3600 s	0.1 s	0 s		
Group 15: Analogue Outputs						
1501	AO1 CONTENT	99...199	1	103		
1502	AO1 CONTENT MIN	-	-	Defined by par. 0103		
1503	AO1 CONTENT MAX	-	-	Defined by par. 0103		
1504	MINIMUM AO1	0.0…20.0 mA	0.1 mA	0 mA		
1505	MAXIMUM AO1	0.0…20.0 mA	0.1 mA	20.0 mA		
1506	FILTER AO1	0…10 s	0.1 s	0.1 s		
1507	AO2 CONTENT	99…199	1	104		
1508	AO2 CONTENT MIN	-	-	Defined by par. 0104		
1509	AO2 CONTENT MAX	-	-	Defined by par. 0104		
1510	MINIMUM AO2	0.0…20.0 mA	0.1 mA	0 mA		
1511	MAXIMUM AO2	0.0…20.0 mA	0.1 mA	20.0 mA		
1512	FILTER AO2	0…10 s	0.1 s	0.1 s		
Group 16: System Controls						
1601	RUN ENABLE	0…7, -1…-6	1	0		✓
1602	PARAMETER LOCK	0…2	1	1		
1603	PASS CODE	0…65535	1	0		
1604	FAULT RESET SEL	0…8, -1…-6	1	0		
1605	USER PAR SET CHG	0…6, -1…-6	1	0		
1606	LOCAL LOCK	0…8, -1…-6	1	0		
1607	PARAM SAVE	0 = Done, 1 = Save	1	0		
Group 20: Limits						
2001	MINIMUM SPEED	-30000…30000 rpm	1 rpm	0 rpm		✓
2002	MAXIMUM SPEED	0…30000 rpm	1 rpm	1500 rpm / US: 1800 rpm		✓
2003	MAX CURRENT	0… 1.8 * I_{hd}	0.1 A	1.8 * I_{hd}		✓
2005	OVERVOLT CTRL	0 = Disable, 1 = Enable	1	1		
2006	UNDERVOLT CTRL	0 = Disable, 1 = Enable	1	1		
2007	MINIMUM FREQ	-500…500 Hz	0.1 Hz	0 Hz		✓
2008	MAXIMUM FREQ	0…500 Hz	0.1 Hz	50 Hz / US: 60 Hz		✓
2013	MIN TORQUE SEL	0…7, -1…-6	1	0		
2014	MAX TORQUE SEL	0…7, -1…-6	1	0		
2015	MIN TORQUE 1	-600.0%…0%	0.1%	-300.0%		

Code	Name	Range	Resolution	Default	User	S
2016	MIN TORQUE 2	-600.0%…0%	0.1%	-300.0%		
2017	MAX TORQUE 1	0%…600.0%	0.1%	300.0%		
2018	MAX TORQUE 2	0%…600.0%	0.1%	300.0%		
Group 21: Start/Stop						
2101	start function	1…5	1	1		
2102	STOP FUNCTION	1 = coast, 2 = ramp	1	1		
2103	DC MAGN TIME	0…10 s	0.01 s	0.3 s		
2104	DC HOLD	0…2	1	0		✓
2105	DC HOLD SPEED	0…3000 rpm	1 rpm	5 rpm		
2106	DC CURR REF	0%…100%	1%	30%		
2107	DC BRAKE TIME	0…250 s	0.1 s	0 s		
2108	START INHIBIT	0 = off, 1 = on	1	0		✓
2109	EM STOP SEL	0…6, -1…-6	1	0		
2110	TORQ BOOST CURR	0…300%	1	100%		
Group 22: Accel/Decel						
2201	ACC/DEC 1/2 SEL	0…6, -1…-6	1	5		
2202	ACCELER TIME 1	0.0…1800 s	0.1 s	5 s		
2203	DECELER TIME 1	0.0…1800 s	0.1 s	5 s		
2204	RAMP SHAPE 1	0=linear; 0.1...1000.0 s	0.1 s	0.0 s		
2205	ACCELER TIME 2	0.0…1800 s	0.1 s	60 s		
2206	DECELER TIME 2	0.0…1800 s	0.1 s	60 s		
2207	RAMP SHAPE 2	0=linear; 0.1...1000.0 s	0.1 s	0.0 s		
2208	EM DEC TIME	0.0…1800 s	0.1 s	1.0 s		
2209	RAMP INPUT 0	0…6, -1…-6	1	0		
Group 23: Speed Control						
2301	PROP GAIN	0.00…200.0	0.01	10		
2302	INTEGRATION TIME	0…600.00 s	0.01 s	2.5		
2303	DERIVATION TIME	0…10000 ms	1 ms	0		
2304	ACC COMPENSATION	0…600.00 s	0.01 s	0		
Group 24: Torque Control						
2401	TORQ RAMP UP	0.00…120.00 s	0.01 s	0		
2402	TORQ RAMP DOWN	0.00…120.00 s	0.01 s	0		
Group 25: Critical Speeds						
2501	CRIT SPEED SEL	0 = OFF, 1 = ON	-	0		
2502	CRIT SPEED 1 LO	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
2503	CRIT SPEED 1 HI	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
2504	CRIT SPEED 2 LO	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
2505	CRIT SPEED 2 HI	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
2506	CRIT SPEED 3 LO	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
2507	CRIT SPEED 3 HI	0…30000 rpm / 0…500 Hz	1 rpm / 0.1 Hz	0 rpm / 0 Hz		
Group 26: Motor Control						
2603	IR COMP VOLT	0.0…20.0%	0.1	0		
2604	IR COMP FREQ	0…100%	1	50		
2605	U/F RATIO	1 = linear, 2 = squared	1	1		
2606	SWITCHING FREQ	1,4,8 kHz	-	4 kHz		

Code	Name	Range	Resolution	Default	User	S
2607	SW FREQ CTRL	0 = OFF, 1 = ON	-	1		
2608	SLIP COMP RATIO	0…200%	1	0		
Group 30: Fault Functions						
3001	AI<MIN FUNCTION	0…3	1	0		
3002	PANEL COMM ERR	1…3	1	1		
3003	EXTERNAL FAULT 1	0…6, -1…-6	1	0		
3004	EXTERNAL FAULT 2	0…6, -1…-6	1	0		
3005	MOT THERM PROT	0…2	1	1		
3006	MOT THERM TIME	256…9999 s	1	500 s		
3007	MOT LOAD CURVE	50…150%	1	100%		
3008	ZERO SPEED LOAD	25…150%	1	70%		
3009	BREAK POINT FREQ	1…250 Hz	1	35 Hz		
3010	STALL FUNCTION	0…2	1	0 (NOT SEL)		
3011	STALL FREQUENCY	0.5…50 Hz	0.1 Hz	20 Hz		
3012	STALL TIME	10…400 s	1 s	20 s		
3013	UNDERLOAD FUNC	0…2	-	0 (NOT SEL)		
3014	UNDERLOAD TIME	10…400 s	1 s	20 s		
3015	UNDERLOAD CURVE	1…5	1	1		
3018	COMM FAULT FUNC	0…3	1	0		
3019	COMM FAULT TIME	0…60.0 s	0.1 s	3.0 s		
3021	AI1 FAULT LIMIT	0…100%	0.1%	0%		
3022	AI2 FAULT LIMIT	0…100%	0.1%	0%		
Group 31: Automatic Reset						
3101	NR OF TRIALS	0…5	1	0		
3102	TRIAL TIME	1.0…600.0 s	0.1 s	30 s		
3103	DELAY TIME	0.0…120.0 s	0.1 s	0 s		
3104	AR OVERCURRENT	0=disable, 1=enable	1	0		
3105	AR OVERVOLTAGE	0=disable, 1=enable	1	0		
3106	AR UNDERVOLTAGE	0=disable, 1=enable	1	0		
3107	AR AI<MIN	0=disable, 1=enable	1	0		
3108	AR EXTERNAL FLT	0=disable, 1=enable	1	0		
Group 32: Supervision						
3201	SUPERV 1 PARAM	101…199	1	103		
3202	SUPERV 1 LIM LO	-	-	0		
3203	SUPERV 1 LIM HI	-	-	0		
3204	SUPERV 2 PARAM	101…199	1	103		
3205	SUPERV 2 LIM LO	-	-	0		
3206	SUPERV 2 LIM HI	-	-	0		
3207	SUPERV 3 PARAM	101…199	1	103		
3208	SUPERV 3 LIM LO	-	-	0		
3209	SUPERV 3 LIM HI	-	-	0		
Group 33: Information						
3301	FW VERSION	0000...FFFF hex	1	Firmware version		
3302	LP VERSION	0000...FFFF hex	1	0		
3303	TEST DATE	yy.ww	1	0		

Code	Name	Range	Resolution	Default	User	S
Group 34: Panel Display / Process Variables						
3401	SIGNAL 1 PARAM	100...199	1	103		
3402	SIGNAL 1 MIN	-	1	-		
3403	SIGNAL 1 MAX	-	1	-		
3404	OUTPUT 1 DSP FORM	0…7	1	-		
3405	OUTPUT 1 UNIT	-128...127	1	.		
3406	OUTPUT 1 MIN	-	1	-		
3407	OUTPUT 1 MAX	-	1	-		
3408	SIGNAL 2 PARAM	100...199	1	104		
3409	SIGNAL 2 MIN	-	1	-		
3410	SIGNAL 2 MAX	-	1	-		
3411	OUTPUT 2 DSP FORM	0…7	1	-		
3412	OUTPUT 2 UNIT	-128...127	1	.		
3413	OUTPUT 2 MIN	-	1	-		
3414	OUTPUT 2 MAX	-	1	-		
3415	SIGNAL 3 PARAM	100...199	1	105		
3416	SIGNAL 3 MIN	-	1	-		
3417	SIGNAL 3 MAX	-	1	-		
3418	OUTPUT 3 DSP FORM	0…7	1	-		
3419	OUTPUT 3 UNIT	-128…127	1	.		
3420	OUTPUT 3 MIN	-	1	-		
3421	OUTPUT 3 MAX	-	1	-		
Group 35: Motor Temp Meas						
3501	SENSOR TYPE	0…4	1	0		
3502	INPUT SELECTION	1=AI 1, 2=AI 2	1	1		
3503	ALARM LIMIT	-10...200 °C / 0...5000 Ohm	1	110 °C / 1500 Ohm		
3504	FAULT LIMIT	-10...200 °C / 0...5000 Ohm	1	130 °C / 4000 Ohm		
Group 40: Process PID Set 1						
4001	GAIN	0.1…100	0.1	1.0		
4002	INTEGRATION TIME	0.0s = NOT SEL, 0.1…600 s	0.1 s	60 s		
4003	DERIVATION TIME	0…10 s	0.1 s	0 s		
4004	PID DERIV FILTER	0…10 s	0.1 s	1 s		
4005	ERROR VALUE INV	0 = no, 1 = yes	-	0		
4006	UNIT	0…31	-	4		
4007	DSP FORMAT	0…4	1	1		
4008	0% VALUE	Unit and scale defined by par. 4006 and 4007	1	0.0%		
4009	100% VALUE	Unit and scale defined by par. 4006 and 4007	1	100%		
4010	SET POINT SEL	0…19	1	1		
4011	INTERNAL SETPNT	Unit and scale defined by par. 4006 and 4007	1	40.0%		
4012	SETPOINT MIN	-500.0%…500.0%	0.1%	0%		
4013	SETPOINT MAX	-500.0%…500.0%	0.1%	100%		
4014	FBK SEL	1…9	-	1		
4015	FBK MULTIPLIER	-32.768…32.767 (0 = not used)	0.001	0		

Code	Name	Range	Resolution	Default	User	S
4016	ACT1 INPUT	1…5	-	2		
4017	ACT2 INPUT	1…5	-	2		
4018	ACT1 MINIMUM	-1000…1000%	1%	0%		
4019	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4020	ACT2 MINIMUM	-1000…1000%	1%	0%		
4021	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4022	SLEEP SELECTION	0…7, -1…-6	-	0		
4023	PID SLEEP LEVEL	0…7200 rpm / 0.0…120 Hz	1 rpm / 0.1 Hz	0 Hz		
4024	PID SLEEP DELAY	0.0…3600 s	0.1 s	60 s		
4025	WAKE-UP DEV	Unit and scale defined by par. 4006 and 4007	1	-		
4026	WAKE-UP DELAY	0…60 s	0.01 s	0.50 s		
4027	PID 1 PARAM SET	-6…7	1	0		
Group 41: Process PID Set 2						
4101	GAIN	0.1…100	0.1	1.0		
4102	INTEGRATION TIME	0.0s = NOT SEL, 0.1…600 s	0.1 s	60 s		
4103	DERIVATION TIME	0…10 s	0.1 s	0 s		
4104	PID DERIV FILTER	0…10 s	0.1 s	1 s		
4105	ERROR VALUE INV	0 = no, 1 = yes	-	0		
4106	UNIT	0…31	-	4		
4107	DSP FORMAT	0…4	1	1		
4108	0% VALUE	Unit and scale defined by par. 4106 and 4107	1	0.0%		
4109	100% VALUE	Unit and scale defined by par. 4106 and 4107	1	100%		
4110	SET POINT SEL	0…19	1	1		
4111	INTERNAL SETPNT	Unit and scale defined by par. 4106 and 4107	1	40.0%		
4112	SETPOINT MIN	-500.0%…500.0%	0.1%	0%		
4113	SETPOINT MAX	-500.0%…500.0%	0.1%	100%		
4114	FBK SEL	1…9	-	1		
4115	FBK MULTIPLIER	-32.768…32.767 (0 = not used)	0.001	0		
4116	ACT1 INPUT	1…5	-	2		
4117	ACT2 INPUT	1…5	-	2		
4118	ACT1 MINIMUM	-1000…1000%	1%	0%		
4119	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4120	ACT2 MINIMUM	-1000…1000%	1%	0%		
4121	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4122	SLEEP SELECTION	0…7, -1…-6	-	0		
4123	PID SLEEP LEVEL	0…7200 rpm / 0.0…120 Hz	1 rpm / 0.1 Hz	0 Hz		
4124	PID SLEEP DELAY	0.0…3600 s	0.1 s	60 s		
4125	WAKE-UP DEV	Unit and scale defined by par. 4106 and 4107	-	-		
4126	WAKE-UP DELAY	0…60 s	0.01 s	0.50 s		
Group 42: External / Trimming PID						
4201	GAIN	0.1…100	0.1	1.0		

Code	Name	Range	Resolution	Default	User	S
4202	INTEGRATION TIME	0.0s = NOT SEL, 0.1…600 s	0.1 s	60 s		
4203	DERIVATION TIME	0…10 s	0.1 s	0 s		
4204	PID DERIV FILTER	0…10 s	0.1 s	1 s		
4205	ERROR VALUE INV	0 = no, 1 = yes	-	0		
4206	UNIT	0…31	-	4		
4207	DSP FORMAT	0…4	1	1		
4208	0% VALUE	Unit and scale defined by par. 4206 and 4207	1	0%		
4209	100% VALUE	Unit and scale defined by par. 4206 and 4207	1	100%		
4210	SET POINT SEL	0…19	1	1		
4211	INTERNAL SETPNT	Unit and scale defined by par. 4206 and 4207	1	40.0%		
4212	SETPOINT MIN	-500.0%…500.0%	0.1%	0%		
4213	SETPOINT MAX	-500.0%…500.0%	0.1%	100%		
4214	FBK SEL	1…9	-	1		
4215	FBK MULTIPLIER	-32.768…32.767 (0 = not used)	0.001	0		
4216	ACT1 INPUT	1…5	-	2		
4217	ACT2 INPUT	1…5	-	2		
4218	ACT1 MINIMUM	-1000…1000%	1%	0%		
4219	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4220	ACT2 MINIMUM	-1000…1000%	1%	0%		
4221	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4228	ACTIVATE	0…8, -1…-6	-	0		
4229	OFFSET	0.0…100.0%	0.1%	0		
4230	TRIM MODE	0…2	1	0		
4231	TRIM SCALE	-100.0%…100.0%	0.1%	100.0%		
4232	CORRECTION SRC	1…2	1	1		
Group 51: Ext Comm Module						
5101	FBA TYPE	-	1	0		
5102… 5126	FBA PAR 2…26	0...65535	1	0		
5127	FBA PAR REFRESH	0 = done, 1 = refresh	1	0		
5128	FILE CPI FW REV	0...0xFFFF	1	0		
5129	FILE CONFIG ID	0...0xFFFF	1	0		
5130	FILE CONFIG REV	0...0xFFFF	1	0		
5131	FBA STATUS	0…6	1	0		
5132	FBA CPI FW REV	0...0xFFFF	1	0		
5133	FBA APPL FW REV	0...0xFFFF	1	0		
Group 52: RS-232 / Panel						
5201	STATION ID	1…247	1	1		
5202	BAUD RATE	9.6, 19.2, 38.4, 57.6, 115.2 kbits/s	-	9.6 kbits/s		
5203	PARITY	0…3	1	0		
5204	OK MESSAGES	0…65535	1	-		
5205	PARITY ERRORS	0…65535	1	-		
5206	FRAME ERRORS	0…65535	1	-		

Code	Name	Range	Resolution	Default	User	S
5207	BUFFER OVERRUNS	0…65535	1	-		
5208	CRC ERRORS	0…65535	1	-		
Group 53: EFB Protocol						
5301	EFB PROTOCOL ID	0...0xFFFF	1	0		
5302	EFB STATION ID	0…65535	1	1		
5303	EFB BAUD RATE	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 kbits/s	-	9.6 kbits/s		
5304	EFB PARITY	0...3		0		
5305	EFB CTRL PROFILE	0 = ABB drives, 1 = ACS550 drives	1	0		
5306	EFB OK MESSAGES	0…65535	1	0		
5307	EFB CRC ERRORS	0…65535	1	0		
5308	EFB UART ERRORS	0…65535	1	0		
5309	EFB STATUS	0…7	1	0		
5310	EFB PAR 10	101…9999	1	0103 OUTPUT FREQ		
5311	EFB PAR 11	101…9999	1	0104 CURRENT		
5312	EFB PAR 12	101…9999	1	0 (NOT SEL)		
5313	EFB PAR 13	101…9999	1	0 (NOT SEL)		
5314	EFB PAR 14	101…9999	1	0 (NOT SEL)		
5315	EFB PAR 15	101…9999	1	0 (NOT SEL)		
5316	EFB PAR 16	101…9999	1	0 (NOT SEL)		
5317	EFB PAR 17	101…9999	1	0 (NOT SEL)		
Group 81: PFC Control						
8103	REFERENCE STEP 1	0.0…100%	0.1%	0%		
8104	REFERENCE STEP 2	0.0…100%	0.1%	0%		
8105	REFERENCE STEP 3	0.0…100%	0.1%	0%		
8109	START FREQ 1	0.0…500 Hz	0.1 Hz	50Hz / US:60 Hz		
8110	START FREQ 2	0.0…500 Hz	0.1 Hz	50 Hz/ US:60 Hz		
8111	START FREQ 3	0.0…500 Hz	0.1 Hz	50 Hz/ US:60 Hz		
8112	LOW FREQ 1	0.0…500 Hz	0.1 Hz	25 Hz/ US:30 Hz		
8113	LOW FREQ 2	0.0…500 Hz	0.1 Hz	25 Hz/ US:30 Hz		
8114	LOW FREQ 3	0.0…500 Hz	0.1 Hz	25 Hz/ US:30 Hz		
8115	AUX MOT START D	0.0…3600 s	0.1 s; 1 s	5 s		
8116	AUX MOT STOP D.	0.0…3600 s	0.1 s; 1 s	3 s		
8117	NR OF AUX MOT	0…3	1	1		✓
8118	AUTOCHNG INTERV	0.0…336 h	0.1 h	0.0 h (NOT SEL)		✓
8119	AUTOCHNG LEVEL	0.0…100.0%	0.1%	50%		
8120	INTERLOCKS	0…6	1	4		✓
8121	REG BYPASS CTRL	0…1	1	0 (NO)		
8122	PFC START DELAY	0…10 s	0.01 s	0.5 s		
8123	PFC ENABLE	0…1	-	0		✓
8124	ACC IN AUX STOP	0.0...1800 s	0.1 s	0.0 s (NOT SEL)		
8125	DEC IN AUX START	0.0...1800 s	0.1 s	0.0 s (NOT SEL)		
Group 98: Options						
9802	COMM PROT SEL	0, 1, 4	1	0		✓

Complete Parameter Descriptions

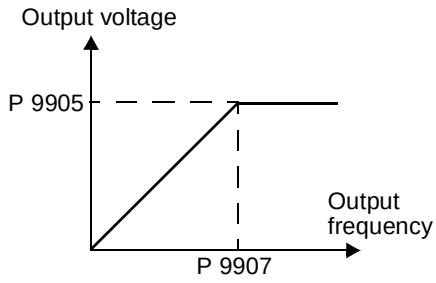
This section describes the actual signals and parameters for ACS550.

Group 99: Start-up Data

This group defines special Start-up data required to:

- Set up the drive.
- Enter motor information.

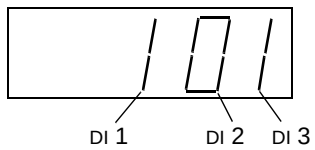
Code	Description
9902	**APPLIC MACRO** Selects an application macro. Application macros automatically edit parameters to configure the ACS550 for a particular application. 1 = ABB STANDARD 2 = 3-WIRE 3 = ALTERNATE 4 = MOTOR POT 5 = HAND/AUTO 6 = PID CONTROL 7 = PFC CONTROL 8 = TORQUE CTRL 9 = USER S1 LOAD 10 = USER S1 SAVE 11 = USER S2 LOAD 12 = USER S2 SAVE
9904	**MOTOR CTRL MODE** Selects the motor control mode. 1 = SPEED CONTROL – sensorless vector control mode. • Reference 1 is speed reference in rpm. • Reference 2 is speed reference in % (100% is absolute maximum speed, equal to the value of parameter 2002 MAXIMUM SPEED, or 2001 MINIMUM SPEED if the absolute value of the minimum speed is greater than the maximum speed). 2 = TORQUE CONTROL. • Reference 1 is speed reference in rpm. • Reference 2 is torque reference in % (100% is nominal torque.) 3 = SCALAR CONTROL – scalar control mode. • Reference 1 is frequency reference in Hz. • Reference 2 is frequency reference in % (100% is absolute maximum frequency, equal to the value of parameter 2008 MAXIMUM FREQUENCY, or 2007 MINIMUM FREQUENCY if the absolute value of the minimum speed is greater than the maximum speed).
9905	**MOTOR NOM VOLT** Defines the nominal motor voltage. • Must equal the value on the motor rating plate. • Sets the maximum drive output voltage supplied to the motor. • The ACS550 cannot supply the motor with a voltage greater than the mains voltage.
9906	**MOTOR NOM CURR** Defines the nominal motor current. • Must equal the value on the motor rating plate. • Range allowed: (0.2…2.0) · I_N (where I_N is drive current).
9907	**MOTOR NOM FREQ** Defines the nominal motor frequency (field weakening point). • Range: 10…500 Hz (typically 50 or 60 Hz) • Sets the frequency at which output voltage equals the MOTOR NOM VOLT.
9908	**MOTOR NOM SPEED** Defines the nominal motor speed. • Must equal the value on the motor rating plate.
9909	**MOTOR NOM POWER** Defines the nominal motor power. • Must equal the value on the motor rating plate.



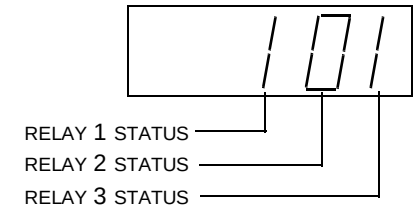
Group 01: Operating Data

This group contains drive operating data, including actual signals. The drive sets the values for actual signals, based on measurements or calculations. You cannot set these values.

Code	Description
0102	**SPEED** The calculated speed of the motor (rpm).
0103	**OUTPUT FREQ** The frequency (Hz) applied to the motor. (Also shown by default in OUTPUT display.)
0104	**CURRENT** The motor current, as measured by the ACS550. (Also shown by default in OUTPUT display.)
0105	**TORQUE** Output torque. Calculated value of torque on motor shaft in % of motor nominal torque.
0106	**POWER** The measured motor power in kW.
0107	**DC BUS VOLTAGE** The DC bus voltage in VDC, as measured by the ACS550.
0109	**OUTPUT VOLTAGE** The voltage applied to the motor.
0110	**DRIVE TEMP** The temperature of the drive heatsink in Centigrade.
0111	**EXTERNAL REF 1** External reference, REF1, in rpm or Hz – units determined by parameter 9904.
0112	**EXTERNAL REF 2** External reference, REF2, in %.
0113	**CTRL LOCATION** Active control location. Alternatives are: 0 = LOCAL 1 = EXT1 2 = EXT2
0114	**RUN TIME (R)** The drive's accumulated running time in hours (h). • Can be **reset** by pressing UP and DOWN buttons simultaneously when in parameter set mode.
0115	**KWH COUNTER (R)** The drive's accumulated power consumption in kilowatt hours. • Can be **reset** by pressing UP and DOWN buttons simultaneously when in parameter set mode.
0116	**APPL BLK OUTPUT** Application block output signal. Value is from either: • PFC control, if PFC Control is active, or • Parameter 0112 EXTERNAL REF 2.
0118	**DI1-3 STATUS** Status of the three digital inputs. • Status is displayed as a binary number. • 1 indicates that the input is activated. • 0 indicates that the input is deactivated.
0119	**DI4-6 STATUS** Status of the three digital inputs. • See parameter 0118 DI1-3 STATUS.
0120	**AI1** Relative value of analog input 1 in %.



Code	Description
0121	**AI2** The relative value of analog input 2 in %.
0122	**RO1-3 STATUS** Status of the three relay outputs. • 1 indicates that the relay is energized. • 0 indicates that the relay is de-energized.
0123	**RO4-6 STATUS** Status of the three relay outputs. See parameter 0122.
0124	**AO1** The analog output 1 value in milliamperes.
0125	**AO2** The analog output 2 value in milliamperes.
0126	**PID 1 OUTPPUT** The PID Controller 1 output value in %.
0127	**PID 2 OUTPUT** The PID Controller 2 output value in %.
0128	**PID 1 SETPNT** The PID 1 controller setpoint signal. • Units and scale defined by PID parameters.
0129	**PID 2 SETPNT** The PID 2 controller setpoint signal. • Units and scale defined by PID parameters.
0130	**PID 1 FBK** The PID 1 controller feedback signal. • Units and scale defined by PID parameters.
0131	**PID 2 FBK** The PID 2 controller feedback signal. • Units and scale defined by PID parameters.
0132	**PID 1 DEVIATION** The difference between the PID 1 controller reference value and actual value. • Units and scale defined by PID parameters.
0133	**PID 2 DEVIATION** The difference between the PID 2 controller reference value and actual value. • Units and scale defined by PID parameters.
0134	**COMM RO WORD** Free data location that can be written from serial link. • Used for relay output control. • See parameter 1401.
0135	**COMM VALUE 1** Free data location that can be written from serial link.
0136	**COMM VALUE 2** Free data location that can be written from serial link.
0137	**PROCESS VAR 1** Process variable 1 • Defined by parameters in Group 34: Panel Display / Process Variables.
0138	**PROCESS VAR 2** Process variable 2 • Defined by parameters in Group 34: Panel Display / Process Variables.



Code	Description
0139	**PROCESS VAR 3** Process variable 3 • Defined by parameters in Group 34: Panel Display / Process Variables.
0140	**RUN TIME** The drive's accumulated running time in thousands of hours (kh).
0141	**MWH COUNTER** The drive's accumulated power consumption in megawatt hours. Can not be reset.
0142	**REVOLUTION CNTR** The motor's accumulated revolutions in millions of revolutions.
0143	**DRIVE ON TIME (HI)** The drive's accumulated power on time in days.
0144	**DRIVE ON TIME (LO)** The drive's accumulated power on time in 2 second ticks (30 ticks = 60 seconds).
0145	**MOTOR TEMP** Motor temperature in degrees centigrade / PTC resistance in Ohms. • Applies only if motor temperature sensor is set up. See parameter 3501.

Group 03: Actual Signals

This group monitors fieldbus communications.

Code	Description
0301	**FB CMD WORD 1** Read-only copy of the Fieldbus Command Word 1. • The fieldbus command is the principal means for controlling the drive from a fieldbus controller. The command consists of two Command Words. Bit-coded instructions in the Command Words switch the drive between states. • To control the drive, using the Command Words, an external location (EXT1 or EXT2) must be active and set to COMM. (See parameters 1001 and 1002.)
0302	**FB CMD WORD 2** Read-only copy of the Fieldbus Command Word 2. • See parameter 0301.
0303	**FB STS WORD 1** Read-only copy of the Status Word 1. • The drive sends status information to the fieldbus controller. The status consists of two Status Words.
0304	**FB STS WORD 2** Read-only copy of the Status Word 2. • See parameter 0303.
0305	**FAULT WORD 1** Read-only copy of the Fault Word 1. • When a fault is active, the corresponding bit for the active fault is set in the Fault Words. • Each fault has a dedicated bit allocated within Fault Words.
0306	**FAULT WORD 2** Read-only copy of the Fault Word 2. • See parameter 0305.
0307	**FAULT WORD 3** Read-only copy of the Fault Word 3. • See parameter 0305.
0308	**ALARM WORD 1** Read-only copy of the ALARM WORD 1. • When a fault is active, the corresponding bit for the active fault is set in the Fault Words. • Each fault has a dedicated bit allocated within Fault Words.
0309	**ALARM WORD 2** Read-only copy of the ALARM WORD 3. • See parameter 0308.

Group 04: Fault History

This group stores a recent history of the faults reported by the drive.

Code	Description
0401	**LAST FAULT** 0 = Clear the fault history (on panel = NO RECORD). n = Fault code of the last recorded fault.
0402	**FAULT TIME 1** The day on which the last fault occurred. Either as: • A date – if real time clock is operating. • The number of days after power on – if real time clock is not used, or was not set.
0403	**FAULT TIME 2** The time at which the last fault occurred. Either as: • Real time, in format hh:mm:ss – if real time clock is operating. • The time since power on (less the whole days reported in 0402), in format hh:mm:ss – if real time clock is not used, or was not set.
0404	**SPEED AT FLT** The motor speed (rpm) at the time the last fault occurred.
0405	**FREQ AT FLT** The frequency (Hz) at the time the last fault occurred.
0406	**VOLTAGE AT FLT** The DC bus voltage (V) at the time the last fault occurred.
0407	**CURRENT AT FLT** The motor current (A) at the time the last fault occurred.
0408	**TORQUE AT FLT** The motor torque (%) at the time the last fault occurred.
0409	**STATUS AT FLT** The drive status (hex code word) at the time the last fault occurred.
0410	**DI1-3 AT FLT** The status of digital inputs 1…3 at the time the last fault occurred.
0411	**DI4-6 AT FLT** The status of digital inputs 4…6 at the time the last fault occurred.
0412	**PREVIOUS FAULT 1** Fault code of the second last fault.
0413	**PREVIOUS FAULT 2** Fault code of the third last fault.

Group 10: Start/Stop/Dir

This group:

- Defines external sources (EXT1, and EXT2) for commands that enable start, stop and direction changes.
- Locks direction or enables direction control.

To select between the two external locations use the next group (parameter 1102).

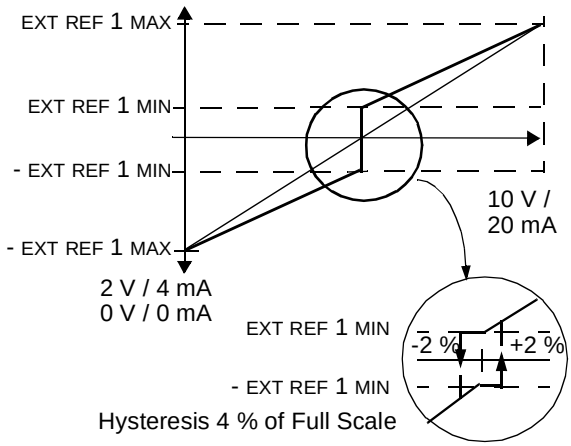
Code	Description
1001	**EXT1 COMMANDS** Defines external control location 1 (EXT1) – the configuration of start, stop and direction commands. 0 = NOT SEL – No external start, stop and direction command source. 1 = DI1 – Two-wire Start/Stop. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (request) is the same as 1003 = 1 (fwd). 2 = DI1, 2 – Two-wire Start/Stop, Direction. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Direction control (requires parameter 1003 = 3 (request)) is through digital input DI2 (DI2 activated = Reverse; de-activated = Forward). 3 = DI1P, 2P – Three-wire Start/Stop. • Start/Stop commands are through momentary push-buttons (the P stands for "pulse"). • Start is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI2 must be activated during the pulse in DI1. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI2. • Connect multiple Stop push-buttons in series. • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FWD). 4 = DI1P, 2P, 3 – Three-wire Start/Stop, Direction. • Start/Stop commands are through momentary push-buttons, as described for DI1P, 2P. • Direction control (requires parameter 1003 = 3 (REQUEST)) is through digital input DI3 (DI3 activated = Reverse; de-activated = Forward). 5 = DI1P, 2P, 3P – Start Forward, Start Reverse, and Stop. • Start and Direction commands are given simultaneously with two separate momentary push-buttons (the P stands for "pulse"). • Start Forward command is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI3 must be activated during the pulse in DI1. • Start Reverse command is through a normally open push-button connected to digital input DI2. In order to start the drive, the digital input DI3 must be activated during the pulse in DI2. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI3. • Connect multiple Stop push-buttons in series. • Requires parameter 1003 = 3 (REQUEST). 6 = DI6 – Two-wire Start/Stop. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FWD). 7 = DI6, 5 – Two-wire Start/Stop/Direction. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Direction control (requires parameter 1003 = 3 (REQUEST)) is through digital input DI5. (DI5 activated = Reverse; de-activated = Forward). 8 = KEYPAD – Control Panel. • Start/Stop and Direction commands are through the control panel when EXT1 is active. • Direction control requires parameter 1003 = 3 (REQUEST). 9 = DI1F, 2R – Start/Stop/Direction commands through DI1 and DI2 combinations. • Start forward = DI1 activated and DI2 de-activated. • Start reverse = DI1 de-activated and DI2 activated. • Stop = both DI1 and DI2 activated, or both de-activated. • Requires parameter 1003 = 3 (REQUEST). 10 = COMM – Assigns the fieldbus Command Word as the source for the start/stop and direction commands. • Bits 0,1, 2 of Command Word 1 (parameter 0301) activates the start/stop and direction commands. • See Fieldbus user's manual for detailed instructions.

Code	Description
1002	**EXT2 COMMANDS** Defines external control location 2 (EXT2) – the configuration of start, stop and direction commands. • See parameter 1001 EXT1 COMMANDS above.
1003	**DIRECTION** Defines the control of motor rotation direction. 1 = FORWARD – Rotation is fixed in the forward direction. 2 = REVERSE – Rotation is fixed in the reverse direction. 3 = REQUEST – Rotation direction can be changed on command.

Group 11: Reference Select

This group defines:

- How the drive selects between command sources.
- Characteristics and sources for REF1 and REF2.

Code	Description
1101	**KEYPAD REF SEL** Selects the reference controlled in local control mode. 1 = REF1 (Hz/rpm) – Reference type depends on parameter 9904 MOTOR CTRL MODE. • Speed reference (rpm) if 9904 = 1 (SPEED CONTROL) or 2 (TORQUE CONTROL). • Frequency reference (Hz) if 9904 = 3 (SCALAR CONTROL). 2 = REF2 (%)
1102	**EXT1/EXT2 SEL** Defines the source for selecting between the two external control locations EXT1 or EXT2. Thus, defines the source for Start/Stop/Direction commands and reference signals. 0 = EXT1 – Selects external control location 1 (EXT1). • See parameter 1001 EXT1 COMMANDS for EXT1's Start/Stop/Dir definitions. • See parameter 1103 REF1 SELECT for EXT1's reference definitions. 1 = DI1 – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT2; DI1 de-activated = EXT1). 2...6 = DI2...DI6 – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1 above. 7 = EXT2 – Selects external control location 2 (EXT2). • See parameter 1002 EXT2 COMMANDS for EXT2's Start/Stop/Dir definitions. • See parameter 1106 REF2 SELECT for EXT2's reference definitions. 8 = COMM – Assigns control of the drive via external control location EXT1 or EXT2 based on the fieldbus control word. • Bit 5 of the Command Word 1 (parameter 0301) defines the active external control location (EXT1 or EXT2). • See Fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT1; DI1 de-activated = EXT2). -2...-6 = DI2(INV)...DI6(INV) – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1(INV) above.
1103	**REF1 SELECT** Selects the signal source for external reference REF1. 0 = KEYPAD – Defines the control panel as the reference source. 1 = AI1 – Defines analog input 1 (AI1) as the reference source. 2 = AI2 – Defines analog input 2 (AI2) as the reference source. 3 = AI1/JOYST – Defines analog input 1 (AI1), configured for joystick operation, as the reference source. • The minimum input signal runs the drive at the maximum reference in the reverse direction. Define the minimum using parameter 1104. • The maximum input signal runs the drive at maximum reference in the forward direction. Define the maximum using parameter 1105. • Requires parameter 1003=3 (request).  **Warning! Because the low end of the reference range commands full reverse operation, do not use 0 V as the lower end of the reference range. Doing so means that if the control signal is lost (which is a 0 V input) the result is full reverse operation. Instead, use the following set-up so that loss of the analog input triggers a fault, stopping the drive:** • Set parameter 1301 MINIMUM AI1 (1304 MINIMUM AI2) at 20% (2 V or 4 mA). • Set parameter 3021 AI1 FAULT LIMIT to a value 5% or higher. • Set parameter 3001 AI<MIN FUNCTION to 1 (FAULT).

4 = AI2/JOYST – Defines analog input 2 (AI2), configured for joystick operation, as the reference source.
• See above (AI2/JOYST) description.
5 = DI3U,4D(R) – Defines digital inputs as the speed reference source (motor potentiometer control).
• Digital input DI3 increases the speed (the U stands for "up").
• Digital input DI4 decreases the speed (the D stands for "down").
• A Stop command resets the reference to zero (the R stands for "reset").
• Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change.
6 = DI3U,4D – Same as above (DI3U,4D(R)), except:
• A Stop command does not reset the reference to zero. The reference is stored.
• When the drive restarts, the motor ramps up (at the selected acceleration rate) to the stored reference.
7 = DI5U,6D – Same as above (DI3U,4D), except that DI5 and DI6 are the digital inputs used.
8 = COMM – Defines the fieldbus as the reference source.
9 = COMM+AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below.
10 = COMM*AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below.
11 = DI3U, 4D(RNC) – Same as DI3U,4D(R) above, except that:
• Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) resets the reference.
12 = DI3U,4D(NC) – Same as DI3U,4D above, except that:
• Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) resets the reference.
13 = DI5U,6D(NC) – Same as DI3U,4D above, except that:
• Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) resets the reference.
14 = AI1+AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
15 = AI1*AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
16 = AI1-AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.

Analog Input Reference Correction

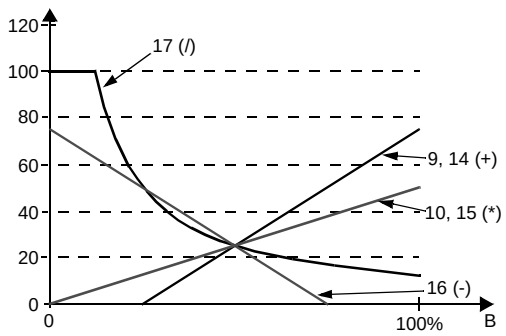
Parameter values 9, 10, and 14…17 use the formulae in the following table.

Value Setting	AI reference is calculated as following:
C + B	C value + (B value - 50% of reference value)
C * B	C value * (B value / 50% of reference value)
C - B	(C value + 50% of reference value) - B value
C / B	(C value * 50% of reference value) / B value

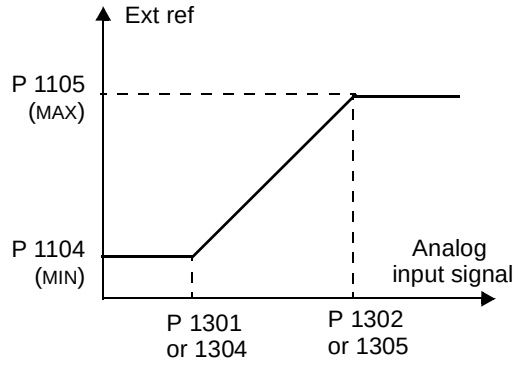
Where:
- C = Main Reference value (= COMM for values 9, 10 and = AI1 for values 14…17).
- B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17).

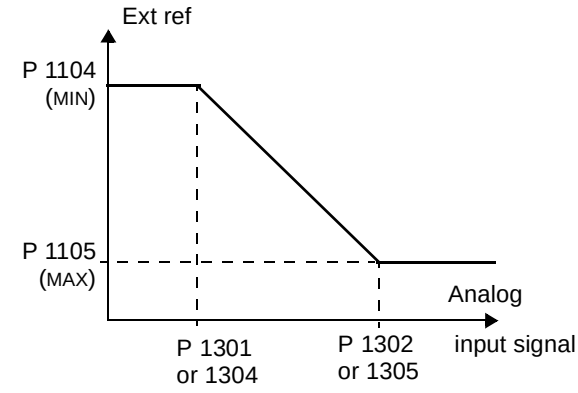
Example:

The figure shows the reference source curves for value settings 9, 10, and 14…17, where:
- C = 25%.
- P 4012 SETPOINT MIN = 0.
- P 4013 SETPOINT MAX = 0.
- B varies along the horizontal axis.

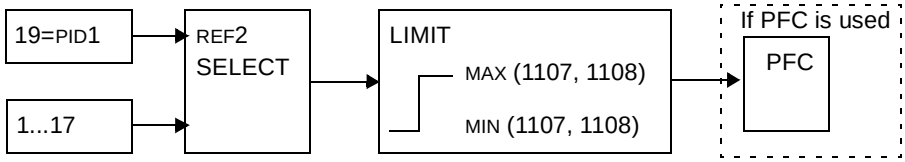


1104	**REF1 MIN** Sets the minimum for external reference 1. • The minimum analog input signal (as a percent of the full signal in volts or amps) corresponds to REF1 MIN in Hz/rpm. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference.
1105	**REF1 MAX** Sets the maximum for external reference 1. • The maximum analog input signal (as a percent of full the signal in volts or amps) corresponds to REF1 MAX in Hz/rpm. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal.





1106	**REF2 SELECT** Selects the signal source for external reference REF2. 0...17 – Same as for parameter 1103 REF1 SELECT. 19 = PID1OUT – The reference is taken from the PID1 output. See Groups 40 and 41.



1107	**REF2 MIN** Sets the minimum for external reference 2. • The minimum analog input signal (in volts or amps) corresponds to REF2 MIN in %. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. • This parameter sets the minimum frequency reference. • The value is a percentage of the maximum frequency or speed.
1108	**REF2 MAX** Sets the maximum for external reference 2. • The maximum analog input signal (in volts or amps) corresponds to REF2 MAX in Hz. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal. • This parameter sets the maximum frequency reference. • The value is a percentage of the maximum frequency or speed.

Group 12: Constant Speeds

This group defines a set of constant speeds. In general:

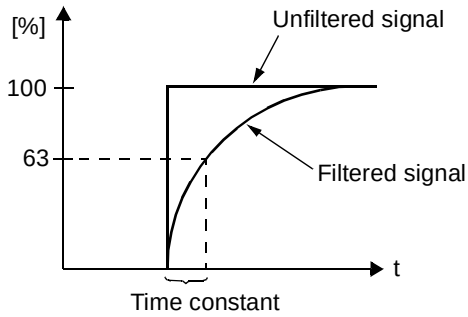
- You can program up to 7 constant speeds, ranging from 0...500 Hz or 0...30000 rpm.
- Values must be positive (No negative speed values for constant speeds).
- Constant speed selections are ignored if:
  - the torque control is active, or
  - the process PID reference is followed, or
  - the drive is in local control mode, or
  - PFC (Pump-Fan Control) is active.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>1201</td><td>CONST SPEED SEL
Defines the digital inputs used to select Constant Speeds.
0 = NOT SEL – Disables the constant speed function.
1 = DI1 – Selects Constant Speed 1 with digital input DI1.
• Digital input activated = Constant Speed 1 activated.
2...6 = DI2...DI6 – Selects Constant Speed 1 with digital input DI2…DI6. See above.
7 = DI1,2 – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
• Uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>Function</th></tr>
<tr><td>0</td><td>0</td><td>No constant speed</td></tr>
<tr><td>1</td><td>0</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>0</td><td>1</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>1</td><td>1</td><td>Constant speed 3 (1204)</td></tr>
</table>
• Can be set up as a so-called fault speed, which is activated if the control signal is lost. Refer to parameter 3001 AI<MIN function and parameter 3002 PANEL COMM ERR.
8 = DI2,3 – Selects one of three Constant Speeds (1…3) using DI2 and DI3.
• See above (DI1,2) for code.
9 = DI3,4 – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
• See above (DI1,2) for code.
10 = DI4,5 – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
• See above (DI1,2) for code.
11 = DI5,6 – Selects one of three Constant Speeds (1…3) using DI5 and DI6.
• See above (DI1,2) for code.
12 = DI1,2,3 – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3.
• Uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>DI3</th><th>Function</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>No constant speed</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Constant speed 3 (1204)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Constant speed 4 (1205)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Constant speed 5 (1206)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Constant speed 6 (1207)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Constant speed 7 (1208)</td></tr>
</table>
13 = DI3,4,5 – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5.
• See above (DI1,2,3) for code.
14 = DI4,5,6 – Selects one of seven Constant Speeds (1…7) using DI5, DI6 and DI7.
• See above (DI1,2,3) for code.
-1 = DI1(INV) – Selects Constant Speed 1 with digital input DI1.
• Inverse operation: Digital input de-activated = Constant Speed 1 activated.
-2...- 6 = DI2(INV)...DI6(INV) – Selects Constant Speed 1 with digital input. See above.</td></tr>
</table>

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
-7 = DI1,2(INV) – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
• Inverse operation uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>Function</th></tr>
<tr><td>1</td><td>1</td><td>No constant speed</td></tr>
<tr><td>0</td><td>1</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>1</td><td>0</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>0</td><td>0</td><td>Constant speed 3 (1204)</td></tr>
</table>
-8 = DI2,3(INV) – Selects one of three Constant Speeds (1…3) using DI2 and DI2.
• See above (DI1,2(INV)) for code.
-9 = DI3,4(INV) – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
• See above (DI1,2(INV)) for code.
-10 = DI4,5(INV) – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
• See above (DI1,2(INV)) for code.
-11 = DI5,6(INV) – Selects one of three Constant Speeds (1…3) using DI5 and DI6.
• See above (DI1,2(INV)) for code.
-12 = DI1,2,3(INV) – Selects one of seven Constant Speeds (1…3) using DI1, DI2 and DI3.
• Inverse operation uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>DI3</th><th>Function</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>No constant speed</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Constant speed 3 (1204)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Constant speed 4 (1205)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Constant speed 5 (1206)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Constant speed 6 (1207)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Constant speed 7 (1208)</td></tr>
</table>
-13 = DI3,4,5(INV) – Selects one of seven Constant Speeds (1…3) using DI3, DI4 and DI5.
• See above (DI1,2,3(INV)) for code.
-14 = DI4,5,6(INV) – Selects one of seven Constant Speeds (1…3) using DI4, DI5 and DI6.
• See above (DI1,2,3(INV)) for code.
</td></tr>
<tr><td>1202</td><td>
CONST SPEED 1
Sets value for Constant Speed 1.
• The range and units depend on parameter 9904 MOTOR CTRL MODE.
• Range: 0…30000 rpm when 9904 = 1 (VECTOR CONTROL) or 2 (TORQUE CONTROL).
• Range: 0…500 Hz when 9904 = 3 (SCALAR CONTROL).
</td></tr>
<tr><td>1203
…
1208</td><td>
CONST SPEED 2…CONST SPEED 7
Each sets a value for a Constant Speed. See CONST SPEED 1 above.
</td></tr>
</table>

Group 13: Analog Inputs

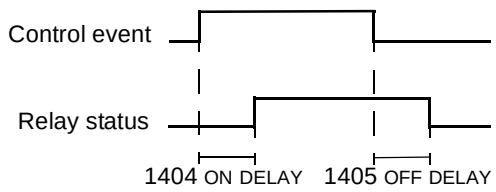
This group defines the limits and the filtering for analog inputs.

Code	Description
1301	**MINIMUM AI1** Defines the minimum value of the analog input. • Define value as a percent of the full analog signal range. See example below. • The minimum analog input signal corresponds to 1104 REF1 MIN or 1107 REF2 MIN. • MINIMUM AI cannot be greater than MAXIMUM AI. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference. • See figure at parameter 1104. **Example.** To set the minimum analog input value to 4 mA: • Configure the analog input for 0…20 mA current signal. • Calculate the minimum (4 mA) as a percent of full range (20 mA) = 4 mA / 20 mA * 100% = 20%
1302	**MAXIMUM AI1** Defines the maximum value of the analog input. • Define value as a percent of the full analog signal range. • The maximum analog input signal corresponds to 1105 REF1 MAX or 1108 REF2 MAX. • See figure at parameter 1104.
1303	**FILTER AI1** Defines the filter time constant for analog input 1 (AI1). • The filtered signal reaches 63% of a step change within the time specified. 
1304	**MINIMUM AI2** Defines the minimum value of the analog input. • See MINIMUM AI1 above.
1305	**MAXIMUM AI2** Defines the maximum value of the analog input. • See MAXIMUM AI1 above.
1306	**FILTER AI2** Defines the filter time constant for analog input 1 (AI1). • See FILTER AI1 above.

Group 14: Relay Outputs

This group defines the condition that activates each of the relay outputs.

Code	Description
1401	**RELAY OUTPUT 1** Defines the event or condition that activates relay 1 – what relay output 1 means. 0 = NOT SEL – Relay is not used and is de-energized. 1 = READY – Energize relay when drive is ready to function. Requires: • Run enable signal present. • No faults exist. • Supply voltage is within range. • Emergency Stop command is not on. 2 = RUN – Energize relay when the drive is running. 3 = FAULT (-1) – Energize relay when power is applied. De-energizes when a fault occurs. 4 = FAULT – Energize relay when a fault is active. 5 = ALARM – Energize relay when an alarm is active. 6 = REVERSED – Energize relay when motor rotates in reverse direction. 7 = STARTED – Energize relay when drive receives a start command (even if Run Enable signal is not present). De-energized relay when drive receives a stop command or a fault occurs. 8= SUPRV1 OVER – Energize relay when first supervised parameter (3201) exceeds the limit (3203). • See "Group 32: Supervision" starting on page 85. 9 = SUPRV1 UNDER – Energize relay when first supervised parameter (3201) drops below the limit (3202). • See "Group 32: Supervision" starting on page 85. 10 = SUPRV2 OVER – Energize relay when second supervised parameter (3204) exceeds the limit (3206). • See "Group 32: Supervision" starting on page 85. 11 = SUPRV2 UNDER – Energize relay when second supervised parameter (3204) drops below the limit (3205). • See "Group 32: Supervision" starting on page 85. 12 = SUPRV3 OVER – Energize relay when second supervised parameter (3207) exceeds the limit (3209). • See "Group 32: Supervision" starting on page 85. 13 = SUPRV3 UNDER – Energize relay when second supervised parameter (3207) drops below the limit (3208). • See "Group 32: Supervision" starting on page 85. 14 = AT SET POINT – Energize relay when the output frequency is equal to the reference frequency. 15 = FAULT (RST) – Energize relay when the drive is in a fault condition and will reset after the programmed auto-reset delay. • See parameter 3103 delay time. 16 = FLT/ALARM – Energize relay when fault or alarm occurs. 17 = EXT CTRL – Energize relay when external control is selected. 18 = REF 2 SEL – Energize relay when EXT2 is selected. 19 = CONST FREQ – Energize relay when a constant speed is selected. 20 = REF LOSS – Energize relay when reference or active control place is lost. 21 = OVERCURRENT – Energize relay when an overcurrent alarm or fault occurs. 22 = OVERVOLTAGE – Energize relay when an overvoltage alarm or fault occurs. 23 = DRIVE TEMP – Energize relay when a drive overtemperature alarm or fault occurs. 24 = UNDERVOLTAGE – Energize relay when an undervoltage alarm or fault occurs. 25 = AI1 LOSS – Energize relay when AI1 signal is lost. 26 = AI2 LOSS – Energize relay when AI2 signal is lost. 27 = MOTOR TEMP – Energize relay when a motor overtemperature alarm or fault occurs. 28 = STALL – Energize relay when a stall alarm or fault exists. 29 = UNDERLOAD – Energize relay when an underload alarm or fault occurs. 30 = PID SLEEP – Energize relay when the PID sleep function is active. 31 = PFC – Use relay to start/stop motor in PFC control (See Group 81: PFC Control). • Use this option only when PFC control is used. • Selection activated / deactivated when drive is not running. 32 = AUTOCHANGE – Energize relay when PFC autochange operation is performed. • Use this option only when PFC control is used. 33 = FLUX READY – Energize relay when the motor is magnetized and able to supply nominal torque (motor has reached nominal magnetizing). 34 = USER S2 – Energize relay when User Parameter Set 2 is active.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>35 = COMM – Energize relay based on input from fieldbus communication.
• Fieldbus writes binary code in parameter 0134 that can energizes relay 1…relay 6 according to the following:
<table><tr><th>Par. 0132</th><th>Binary</th><th>RO6</th><th>RO5</th><th>RO4</th><th>RO3</th><th>RO2</th><th>RO1</th></tr><tr><td>0</td><td>000000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>000001</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>2</td><td>000010</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>3</td><td>000011</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>4</td><td>000100</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>5...62</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td></tr><tr><td>63</td><td>111111</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>• 0 = De-energize relay, 1 = Energize relay.
36 = COMM(-1) – Energize relay based on input from fieldbus communication.
• Fieldbus writes binary code in parameter 0134 that can energizes relay 1…relay 6 according to the following:
<table><tr><th>Par. 0132</th><th>Binary</th><th>RO6</th><th>RO5</th><th>RO4</th><th>RO3</th><th>RO2</th><th>RO1</th></tr><tr><td>0</td><td>000000</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>000001</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>2</td><td>000010</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>3</td><td>000011</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>4</td><td>000100</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>5...62</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td></tr><tr><td>63</td><td>111111</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>• 0 = De-energize relay, 1 = Energize relay.</td></tr>
<tr><td>1402</td><td>RELAY OUTPUT 2
Defines the event or condition that activates relay 2 – what relay output 2 means.
• See 1401 RELAY OUTPUT 1.</td></tr>
<tr><td>1403</td><td>RELAY OUTPUT 3
Defines the event or condition that activates relay 3 – what relay output 3 means.
• See 1401 RELAY OUTPUT 1.</td></tr>
<tr><td>1404</td><td>RO 1 ON DELAY
Defines the switch-on delay for relay 1.
• On / off delays are ignored when relay output 1401 is set to PFC.</td><td rowspan="2"> 
</td></tr>
<tr><td>1405</td><td>RO 1 OFF DELAY
Defines the switch-off delay for relay 1.
• On / off delays are ignored when relay output 1401 is set to PFC.</td></tr>
<tr><td>1406</td><td>RO 2 ON DELAY
Defines the switch-on delay for relay 2.
• See RO 1 ON DELAY.</td></tr>
<tr><td>1407</td><td>RO 2 OFF DELAY
Defines the switch-off delay for relay 2.
• See RO 1 OFF DELAY.</td></tr>
<tr><td>1408</td><td>RO 3 ON DELAY
Defines the switch-on delay for relay 3.
• See RO 1 ON DELAY.</td></tr>
<tr><td>1409</td><td>RO 3 OFF DELAY
Switch-off delay for relay 3.
• See RO 1 OFF DELAY.</td></tr>
<tr><td>1410
…
1412</td><td>RELAY OUTPUT 4…6
Defines the event or condition that activates relay 4…6 – what relay output 4…6 means.
• See 1401 RELAY OUTPUT 1.</td></tr>
</table>

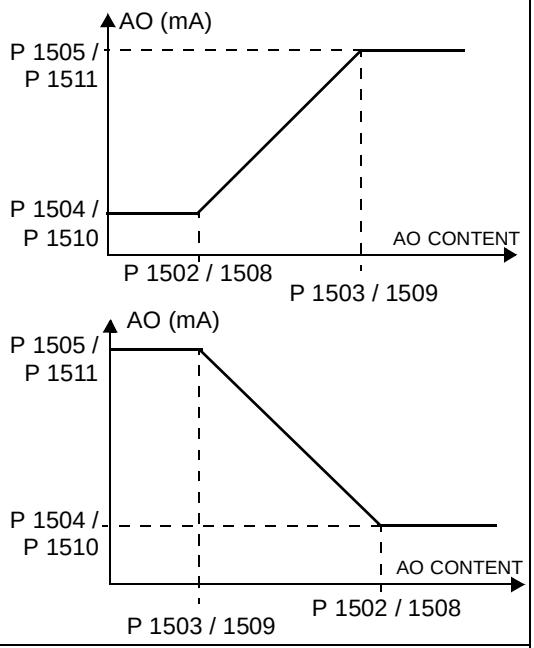
Code	Description
1413	**RO 4 ON DELAY** Defines the switch-on delay for relay 4. • See RO 1 ON DELAY.
1414	**RO 4 OFF DELAY** Defines the switch-off delay for relay 4. • See RO 1 OFF DELAY.
1415	**RO 5 ON DELAY** Defines the switch-on delay for relay 5. • See RO 1 ON DELAY.
1416	**RO 5 OFF DELAY** Defines the switch-off delay for relay 5. • See RO 1 OFF DELAY.
1417	**RO 6 ON DELAY** Defines the switch-on delay for relay 6. • See RO 1 ON DELAY.
1418	**RO 6 OFF DELAY** Defines the switch-off delay for relay 6. • See RO 1 OFF DELAY.

Group 15: Analog Outputs

This group defines the drive's analog (current signal) outputs. The drive's analog outputs can be:

- Any parameter of the Operating Data group (Group 01).
- Limited to programmable minimum and maximum values of output current.
- Scaled (and/or inverted) by defining the minimum and maximum values of the source parameter (or content). Defining an maximum value (parameter 1503 or 1509) that is less than the content minimum value (parameter 1502 or 1508) results in an inverted output.
- Filtered.

Code	Description
1501	**AO1 CONTENT** Defines the content for analog output AO1. 99 = EXCITE PTC – Provides a current source for sensor type PTC. Output = 1.6 mA. See Group 35. 100 = EXCITE PT100 – Provides a current source for sensor type Pt100. Output = 9.1 mA. See Group 35. 101...145 – Output corresponds to a parameter in the Operating Data group (Group 01). • Parameter defined by value (value 102 = parameter 0102)
1502	**AO1 CONTENT MIN** Sets the minimum content value. • Content is the parameter selected by parameter 1501. • Minimum value refers to the minimum content value that will be converted to an analog output. • These parameters (content and current min. and max. settings) provide scale and offset adjustment for the output. See figure.
1503	**AO1 CONTENT MAX** Sets the maximum content value • Content is the parameter selected by parameter 1501. • Maximum value refers to the maximum content value that will be converted to an analog output.
1504	**MINIMUM AO1** Sets the minimum output current.
1505	**MAXIMUM AO1** Sets the maximum output current.
1506	**FILTER AO1** Defines the filter time constant for AO1. • The filtered signal reaches 63% of a step change within the time specified. • See figure in parameter 1303.
1507	**AO2 CONTENT** Defines the content for analog output AO1. See AO1 CONTENT above.
1508	**AO2 CONTENT MIN** Sets the minimum content value. See AO1 CONTENT MIN above.
1509	**AO2 CONTENT MAX** Sets the maximum content value. See AO1 CONTENT MAX above.
1510	**MINIMUM AO2** Sets the minimum output current. See MINIMUM AO1 above.
1511	**MAXIMUM AO2** Sets the maximum output current. See MAXIMUM AO1 above.
1512	**FILTER AO2** Defines the filter time constant for AO1. See FILTER AO1 above.



Group 16: System Controls

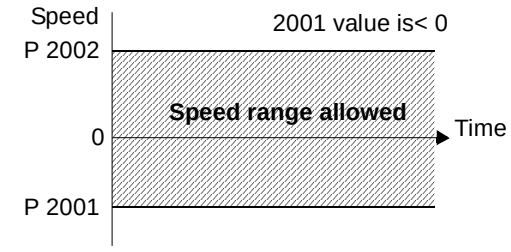
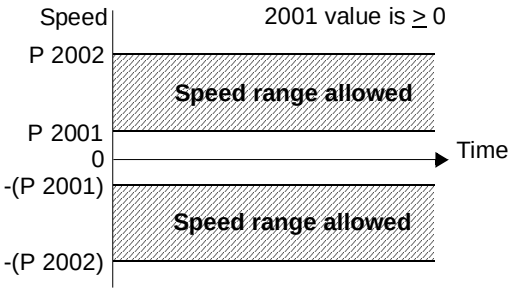
This group defines a variety of system level locks, resets and enables.

Code	Description
1601	**RUN ENABLE** Selects the source of the run enable signal. 0 = NOT SEL – Allows the drive to start without an external run enable signal. 1 = DI1 – Defines digital input DI1 as the run enable signal. • This digital input must be activated for run enable. • If the voltage drops and de-activates this digital input, the drive will coast to stop and not start until the run enable signal resumes. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the run enable signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the run enable signal. • Bit 6 of the Command Word 1 (parameter 0301) activates the run disable signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the run enable signal. • This digital input must be de-activated for run enable. • If this digital input activates, the drive will coast to stop and not start until the run enable signal resumes. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the run enable signal. • See DI1(INV) above.
1602	**PARAMETER LOCK** Determines if the control panel can change parameter values. • This lock does not limit parameter changes made by macros. • This lock does not limit parameter changes written by fieldbus inputs. 0 = LOCKED – You cannot use the control panel to change parameter values. • The lock can be opened by entering the valid pass code to parameter 1603. 1 = OPEN – You can use the control panel to change parameter values. 2 = NOT SAVED – You can use the control panel to change parameter values, but they are not stored in permanent memory. • Set parameter 1607 PARAM SAVE to 1 (SAVE) to store changed parameter values to memory.
1603	**PASS CODE** Entering the correct pass code unlocks the parameter lock. • See parameter 1602 above. • The code 358 opens the lock. • This entry reverts back to 0 automatically.
1604	**FAULT RESET SEL** Selects the source for the fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 = KEYPAD – Defines the control panel as the only fault reset source. • Fault reset is always possible with control panel. 1 = DI1 – Defines digital input DI1 as a fault reset source. • Activating the digital input resets the drive. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as a fault reset source. • See DI1 above. 7 = START/STOP – Defines the Stop command as a fault reset source. • Do not use this option when fielbus communication provides the start, stop and direction commands. 8 = COMM – Defines the fieldbus as a fault reset source. • The Command Word is supplied through fieldbus communication. • The bit 4 of the Command Word 1 (parameter 0301) resets the drive. -1 = DI1(INV) – Defines an inverted digital input DI1 as a fault reset source. • De-activating the digital input resets the drive. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as a fault reset source. • See DI1(INV) above.

Code	Description
1605	**USER PAR SET CHG** Defines control for changing the user parameter set. • See parameter 9902 (APPLIC MACRO). • The drive must be stopped to change User Parameter Sets. • During a change, the drive will not start. **Note:** Always save the User Parameter Set after changing any parameter settings, or performing a motor identification. • Whenever the power is cycled, or parameter 9902 (APPLIC MACRO) is changed, the drive loads the last settings saved. Any unsaved changes to a user parameter set are lost. **Note:** The value of this parameter (1605) is not included in the User Parameter Sets, and does not change if User Parameter Sets change. **Note:** You can use a relay output to supervise the selection of User Parameter Set 2. • See parameter 1401. 0 = NOT SEL – Defines the control panel (using parameter 9902) as the only control for changing User Parameter Sets. 1 = DI1 – Defines digital input DI1 as a control for changing User Parameter Sets. • The drive loads User Parameter Set 1 on the falling edge of the digital input. • The drive loads User Parameter Set 2 on the rising edge of the digital input. • The User Parameter Set changes only when the drive is stopped. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as a control for changing User Parameter Sets. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as a control for changing User Parameter Sets. • The drive loads User Parameter Set 1 on the rising edge of the digital input. • The drive loads User Parameter Set 2 on the falling edge of the digital input. • The User Parameter Set changes only when the drive is stopped. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as a control for changing User Parameter Sets. • See DI1(INV) above.
1606	**LOCAL LOCK** Defines control for the use of the LOC mode. The LOC mode allows drive control from the control panel. • When LOCAL LOCK is active, the control panel cannot change to LOC mode. 0 = NOT SEL – Disables the lock. The control panel can select LOC and control the drive. 1 = DI1 – Defines digital input DI1 as the control for setting the local lock. • Activating the digital input locks out local control. • De-activating the digital input enable the LOC selection. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for setting the local lock. • See DI1 above. 7 = ON – Sets the lock. The control panel cannot select LOC, and cannot control the drive. 8 = COMM – Defines bit 14 of the Command Word 1 as the control for setting the local lock. • The Command Word is supplied through fieldbus communication. • The Command Word is 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for setting the local lock. • De-activating the digital input locks out local control. • Activating the digital input enable the LOC selection. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for setting the local lock. • See DI1(INV) above.
1607	**PARAM. SAVE** Saves all altered parameters to permanent memory. • Parameters altered through a fieldbus are not automatically saved to permanent memory. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 2 (NOT SAVED), parameters altered from the control panel are not saved. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 1 (OPEN), parameters altered from the control panel are stored immediately to permanent memory. 0 = DONE – Value changes automatically when all parameters are saved. 1 = SAVE – Saves altered parameters to permanent memory.

Group 20: Limits

This group defines minimum and maximum limits to follow in driving the motor – speed, frequency, current, torque, etc.

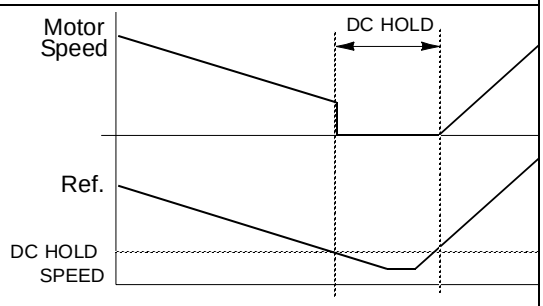
Code	Description
2001	**MINIMUM SPEED** Defines the minimum speed (rpm) allowed. • A positive minimum speed value defines two ranges, one positive and one negative. • A negative (or zero) minimum speed value defines one speed range. • See figure. 
2002	**MAXIMUM SPEED** Defines the maximum speed (rpm) allowed. 
2003	**MAX CURRENT** Defines the maximum output current (A) supplied by the drive to the motor.
2005	**OVERVOLT CTRL** Sets the DC overvoltage controller on or off. • Fast braking of a high inertia load causes the DC bus voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the trip limit, the overvoltage controller automatically decreases the braking torque by increasing output frequency. 0 = DISABLE – Disables controller. 1 = ENABLE – Enables controller **Warning! If a braking chopper and a braking resistor are connected to the drive, this parameter value must be set to 0 to ensure proper operation of the chopper.**
2006	**UNDERVOLT CTRL** Sets the DC undervoltage controller on or off. When on: • If the DC bus voltage drops due to loss of input power, the undervoltage controller decreases the motor speed in order to keep the DC bus voltage above the lower limit. • When the motor speed decreases, the inertia of the load causes regeneration back into the drive, keeping the DC bus charged, and preventing an undervoltage trip. • The DC undervoltage controller increases power loss ride-through on systems with a high inertia, such as a centrifuge or a fan. 0 = DISABLE – Disables controller. 1 = ENABLE – Enables controller without a maximum time limit for operation.
2007	**MINIMUM FREQ** Defines the minimum limit for the drive output frequency. **Note!** Keep MINIMUM FREQ ≤ MAXIMUM FREQ.
2008	**MAXIMUM FREQ** Defines the maximum limit for the drive output frequency.

Code	Description
2013	**MIN TORQUE SEL** Defines control of the selection between two minimum torque limits (2015 MIN TORQUE 1 and 2016 MIN TORQUE 2). 0 = MIN TORQUE 1 – Selects 2015 MIN TORQUE 1 as the minimum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 2 value. • De-activating the digital input selects MIN TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the minimum limit used. • The Command Word is supplied through fieldbus communication. The Command Word is a parameter 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 1 value. • De-activating the digital input selects MIN TORQUE 2 value. -2…-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1(INV) above.
2014	**MAX TORQUE SEL** Defines control of the selection between two maximum torque limits (2017 MAX TORQUE 1 and 2018 MAX TORQUE 2). 0 = MAX TORQUE 1 – Selects 2017 MAX TORQUE 1 as the maximum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the maximum limit used. Activating the digital input selects MAX TORQUE 2 value. De-activating the digital input selects MAX TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the maximum limit used. • The Command Word is supplied through fieldbus communication. • The Command Word is a parameter 0301. -1 = DI1(INV) – Defines an inverted digital input di1 as the control for selecting the maximum limit used. • Activating the digital input selects MAX TORQUE 1 value. • De-activating the digital input selects MAX TORQUE 2 value. -2…-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1(INV) above.
2015	**MIN TORQUE 1** Sets the first minimum limit for torque (%). Value is a percent of the motor nominal torque.
2016	**MIN TORQUE 2** Sets the second minimum limit for torque (%). Value is a percent of the motor nominal torque.
2017	**MAX TORQUE 1** Sets the first maximum limit for torque (%). Value is a percent of the motor nominal torque.
2018	**MAX TORQUE 2** Sets the second maximum limit for torque (%). Value is a percent of the motor nominal torque.

Group 21: Start/Stop

This group defines how the motor starts and stops. The ACS550 supports several start and stop modes.

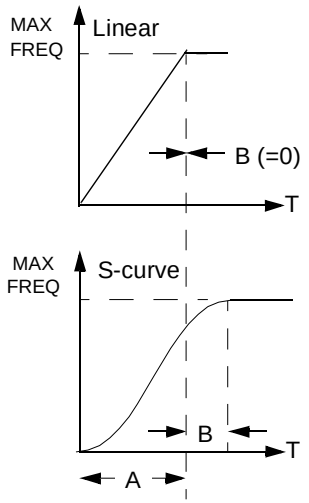
Code	Description
2101	**START FUNCTION** Selects the motor start method. 1 = AUTO – Selects the automatic start mode. • VECTOR control mode: Optimal start in most cases. Flying start function to a rotating axis and start at zero speed. • SCALAR control mode: Immediate start from zero frequency. 2 = DC MAGN – Selects the DC Magnetizing start mode. **Note!** Mode cannot start a rotating motor. **Note!** The drive starts when the set pre-magnetizing time (param. 2103) has passed, even if motor magnetization is not complete. • VECTOR control mode: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. This selection guarantees the highest possible break-away torque. • SCALAR control mode: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. 3 = SCALAR FLYSTART – Selects the flying start mode. • VECTOR control mode: Not applicable. • SCALAR control mode: The drive will automatically selects the correct output frequency to start a rotating motor. Useful if the motor is already rotating and the drive will start smoothly at the current frequency. 4 = TORQ BOOST – Selects the automatic torque boost mode (SCALAR control mode only). • May be necessary in drives with high starting torque. • Torque boost is only applied at start, ending when output frequency exceeds 20 Hz or when output frequency is equal to reference. • In the beginning the motor magnetizes within the time determined by the parameter 2103 DC MAGN TIME using DC current. • See parameter 2110 TORQ BOOST CURR. 5 = FLYSTART + TORQ BOOST – Selects both the flying start and the torque boost mode (SCALAR control mode only). • Flying start routine is performed first and the motor is magnetized. If the speed is found to be zero, the torque boost is done.
2102	**STOP FUNCTION** Selects the motor stop method. 1 = COAST – Selects cutting off the motor power as the stop method. The motor coasts to stop. 2 = RAMP – Selects using a deceleration ramp • Deceleration ramp is defined by 2203 DECELER TIME 1 or 2206 DECELER TIME 2 (whichever is active).
2103	**DC MAGN TIME** Defines the pre-magnetizing time for the DC Magnetizing start mode. • Use parameter 2101 to select the start mode. • After the start command, the drive pre-magnetizes the motor for the time defined here, and then starts the motor. • Set the pre-magnetizing time just long enough to allow full motor magnetization. Too long a time heats the motor excessively.
2104	**DC HOLD** Selects whether DC current is used for braking. 0 = NOT SEL – Disables the DC current operation. 1 = SPD CONTROL – Enables the DC Injection Braking. • Enables DC Injection braking after modulation has stopped. • If parameter 2102 STOP FUNCTION is 1 (COAST), braking is applied after start is removed. • If parameter 2102 STOP FUNCTION IS 2 (RAMP), braking is applied after ramp.
2105	**DC HOLD SPEED** Not presently used.
2106	**DC CURR REF** Defines the DC hold current reference.
2107	**DC BRAKE TIME** Defines the DC brake time after modulation has stopped, if parameter 2104 is 2 (RUN CONTROL).



Code	Description
2108	**START INHIBIT** Sets the Start inhibit function on or off. The Start inhibit function ignores a pending start command in any of the following situations (a new start command is required): • A fault is reset. • Run Enable activates while start command is active. • Mode changes from local to remote. • Mode changes from remote to local. • Control switches from EXT1 to EXT2. • Control switches from EXT2 to EXT1. 0 = OFF – Disables the Start inhibit function. 1 = ON – Enables the Start inhibit function.
2109	**EM STOP SEL** Defines control of the Emergency stop command. When activated: • Emergency stop decelerates the motor using the emergency stop ramp (parameter 2208 EM DEC TIME). • Requires an external stop command and removal of the emergency stop command before drive can restart. 0 = NOT SEL – Disables the Emergency stop function through digital inputs. 1 = DI1 – Defines digital input DI1 as the control for Emergency stop command. • Activating the digital input issues an Emergency stop command. • De-activating the digital input removes the Emergency stop command. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for Emergency stop command. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for Emergency stop command. • De-activating the digital input issues an Emergency stop command. • Activating the digital input removes the Emergency stop command. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for Emergency stop command. • See DI1(INV) above.
2110	**TORQ BOOST CURR** Sets the maximum supplied current during torque boost. • See parameter 2101 START FUNCTION.

Group 22: Accel/Decel

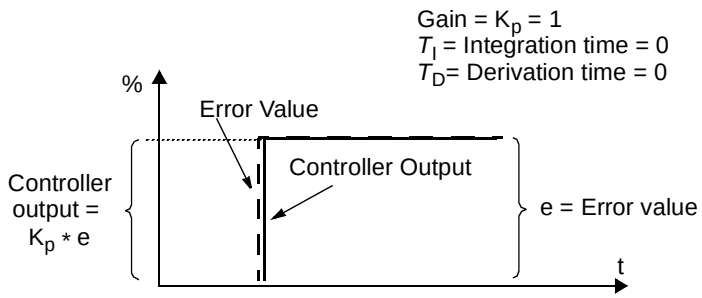
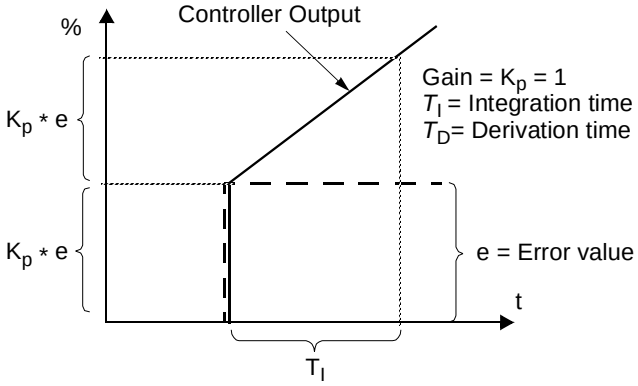
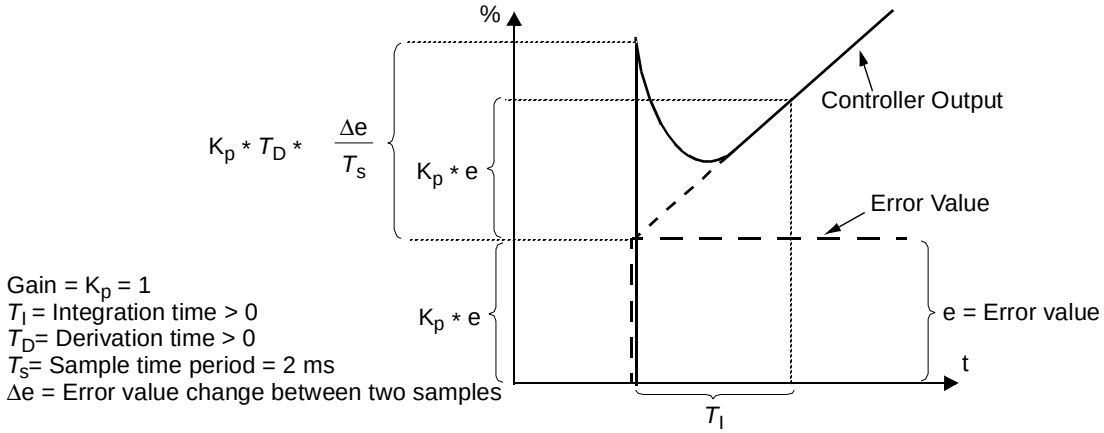
This group defines ramps that control the rate of acceleration and deceleration. You define these ramps as a pair, one for acceleration and one for deceleration. You can define two pairs of ramps and use a digital input to select one or the other pair.

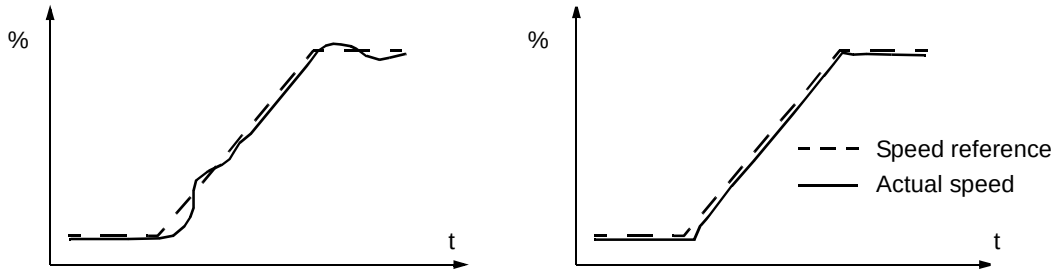
Code	Description
2201	**ACC/DEC 1/2 SEL** Defines control for selection of acceleration/deceleration ramps. • Ramps are defined in pairs, one each for acceleration and deceleration. • See below for the ramp definition parameters. 0 = NOT SEL – Disables selection, the first ramp pair is used. 1 = DI1 – Defines digital input DI1 as the control for ramp pair selection. • Activating the digital input selects ramp pair 2. • De-activating the digital input selects ramp pair 1. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for ramp pair selection. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for ramp pair selection. • De-activating the digital input selects ramp pair 2 • Activating the digital input selects ramp pair 1. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for ramp pair selection. • See DI1(INV) above.
2202	**ACCELER TIME 1** Sets the acceleration time for zero to maximum frequency for ramp pair 1. See A in figure. • Actual acceleration time also depends on 2204 RAMP SHAPE. • See 2008 MAXIMUM FREQUENCY.
2203	**DECELER TIME 1** Sets the deceleration time for maximum frequency to zero for ramp pair 1. • Actual deceleration time also depends on 2204 RAMP SHAPE. • See 2008 MAXIMUM FREQUENCY.
2204	**RAMP SHAPE 1** Selects the shape of the acceleration/deceleration ramp for ramp pair 1. See B in figure. • Shape is defined as a ramp, unless additional time is specified here to reach the maximum frequency. A longer time provides a softer transition at each end of the slope. The shape becomes an s-curve. • Rule of thumb: 1/5 is a suitable relation between the ramp shape time and the acceleration ramp time. 0.0 = LINEAR – Specifies linear acceleration/deceleration ramps for ramp pair 1. 0.1...1000.0 = S-CURVE – Specifies s-curve acceleration/deceleration ramps for ramp pair 1.
	 A = 2202 ACCELERATION TIME B = 2204 RAMP SHAPE
2205	**ACCELER TIME 2** Sets the acceleration time (s) for zero to maximum frequency for ramp pair 2. See 2002 ACCELER TIME 1.
2206	**DECELER TIME 2** Sets the deceleration time for maximum frequency to zero for ramp pair 2. See 2003 DECELER TIME 1.
2207	**RAMP SHAPE 2** Selects the shape of the acceleration/deceleration ramp for ramp pair 2. See 2004 RAMP SHAPE 1.
2208	**EM DEC TIME** Sets the deceleration time for maximum frequency to zero for an emergency. • See parameter 2109 EM STOP SEL. • Ramp is linear.

Code	Description
2209	**RAMP INPUT 0** Defines control for forcing the ramp input to 0. 0 = NOT SEL – 1 = DI1 – Defines digital input DI1 as the control for forcing the ramp input to 0. • Activating the digital input forces ramp input to 0. Ramp output will ramp to 0 according to the currently used ramp time, after which it will stay at 0. • De-activating the digital input: ramp resumes normal operation. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for forcing the ramp input to 0. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for forcing the ramp input to 0. • De-activating the digital input forces ramp input to 0. • Activating the digital input: ramp resumes normal operation. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for forcing the ramp function generator input to 0. • See DI1(INV) above.

Group 23: Speed Control

This group defines variables used for speed control operation.

Code	Description
2301	**PROP GAIN** Sets the relative gain for the speed controller. • Larger values may cause speed oscillation. • The figure shows the speed controller output after an error step (error remains constant). 
2302	**INTEGRATION TIME** Sets the integration time for the speed controller. • The integration time defines the rate at which the controller output changes for a constant error value. • Shorter integration times correct continuous errors faster. • Control becomes unstable if the integration time is too short. • The figure shows the speed controller output after an error step (error remains constant). 
2303	**DERIVATION TIME** Sets the derivation time for the speed controller. • Derivative action makes the control more responsive to error value changes. • The longer the derivation time, the more the speed controller output is boosted during the change. • If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. **Note:** Use this parameter only when a pulse encoder is used. The figure below shows the speed controller output after an error step when the error remains constant. 

Code	Description
2304	**ACC COMPENSATION** Sets the derivation time for acceleration compensation. • Adding a derivative of the reference to the output of the speed controller compensates for inertia during acceleration. • 2303 DERIVATION TIME describes the principle of derivative action. • Rule of thumb: Set this parameter between 50 and 100% of the sum of the mechanical time constants for the motor and the driven machine. • The figure shows the speed responses when a high inertia load is accelerated along a ramp. **No Acceleration Compensation** **Acceleration Compensation** 

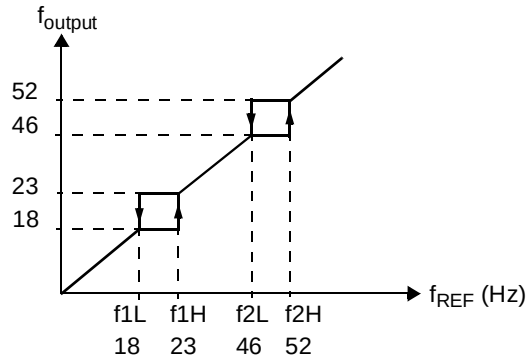
Group 24: Torque Control

This group defines variables used for torque control operation.

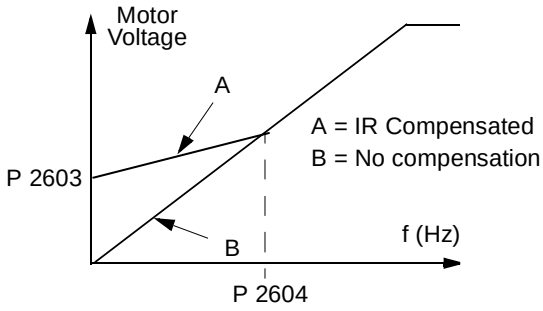
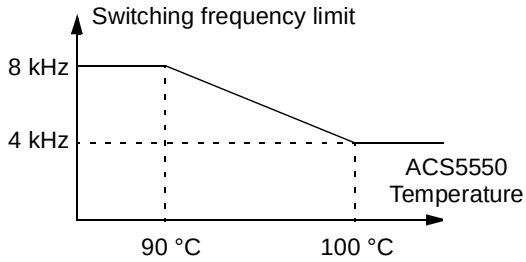
Code	Description
2401	**TORQ RAMP UP** Defines the torque reference ramp up time – The minimum time for the reference to increase from zero to the nominal motor torque.
2402	**TORQ RAMP DOWN** Defines the torque reference ramp down time – The minimum time for the reference to decrease from the nominal motor torque to zero.

Group 25: Critical Speeds

This group defines up to three critical speeds or ranges of speeds that are to be avoided due, for example, to mechanical resonance problems at certain speeds.

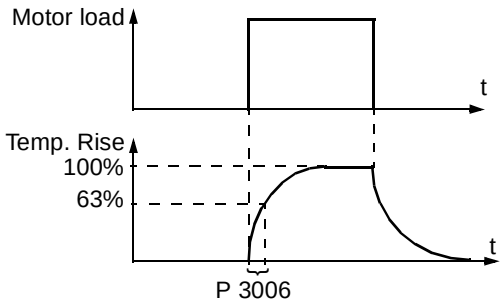
Code	Description
2501	**CRIT SPEED SEL** Sets the critical speeds function on or off. The critical speed function avoids specific speed ranges. 0 = OFF – Disables the critical speeds function. 1 = ON – Enables the critical speeds function. **Example**: To avoid speeds at which a fan system vibrates badly: • Determine problem speed ranges. Assume they are found to be: 18…23 Hz and 46…52 Hz. • Set 2501 CRIT SPEED SEL = 1. • Set 2502 CRIT SPEED 1 LO = 18 Hz. • Set 2503 CRIT SPEED 1 HI = 23 Hz. • Set 2504 CRIT SPEED 2 LO = 46 Hz. • Set 2505 CRIT SPEED 2 HI = 52 Hz. 
2502	**CRIT SPEED 1 LO** Sets the minimum limit for critical speed range 1. • The value must be less than or equal to 2503 CRIT SPEED 1 HI. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR CONTROL), then units are Hz.
2503	**CRIT SPEED 1 HI** Sets the maximum limit for critical speed range 1. • The value must be greater than or equal to 2502 CRIT SPEED 1 LO. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR CONTROL), then units are Hz.
2504	**CRIT SPEED 2 LO** Sets the minimum limit for critical speed range 2. • See parameter 2502.
2505	**CRIT SPEED 2 HI** Sets the maximum limit for critical speed range 2. • See parameter 2503.
2506	**CRIT SPEED 3 LO** Sets the minimum limit for critical speed range 3. • See parameter 2502.
2507	**CRIT SPEED 3 HI** Sets the maximum limit for critical speed range 3. • See parameter 2503.

Group 26: Motor Control

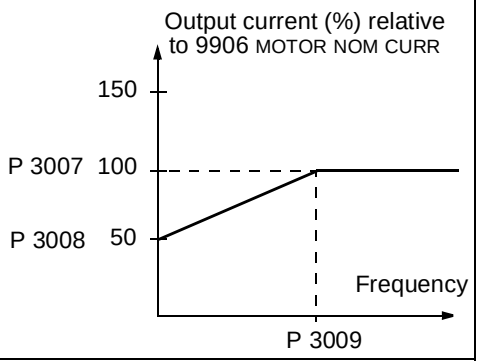
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>2603</td><td>IR COMP VOLT
Sets the IR compensation voltage used for 0 Hz.
• Requires parameter 9904 MOTOR CTRL MODE = 3 (SCALAR CONTROL).
• Keep IR compensation as low as possible to prevent overheating.
• Typical IR compensation values are:
<table><tr><th colspan="6">400 V Units</th></tr><tr><td>P_N (kW)</td><td>3</td><td>7.5</td><td>15</td><td>37</td><td>132</td></tr><tr><td>IR comp (V)</td><td>21</td><td>18</td><td>15</td><td>10</td><td>4</td></tr></table></td><td rowspan="2">IR Compensation
• When enabled, IR Compensation provides an extra voltage boost to the motor at low speeds. Use IR Compensation, for example, in applications that require a high breakaway torque.
 
</td></tr>
<tr><td>2604</td><td>IR COMP FREQ
Sets the frequency at which IR compensation is 0 V.</td></tr>
<tr><td>2605</td><td colspan="2">U/f RATIO
Selects the form for the U/f (voltage to frequency) ratio below field weakening point.
1 = LINEAR – Preferred for constant torque applications.
2 = SQUARE – Preferred for centrifugal pump and fan applications. (Square is more silent for most operating frequencies.)</td></tr>
<tr><td>2606</td><td colspan="2">SWITCHING FREQ
Sets the switching frequency for the drive.
• Higher switching frequencies mean less noise.</td></tr>
<tr><td>2607</td><td colspan="2">SW FREQ CTRL
The switching frequency may be reduced if the ACS550 internal temperature rises above 90 °C. See Figure. This function allows the highest possible switching frequency to be used based on operating conditions. Higher switching frequency results in lower acoustic noise.
0 = OFF – The function is disabled.
1 = ON – The switching frequency is limited according to the figure.
 
</td></tr>
<tr><td>2608</td><td colspan="2">SLIP COMP RATIO
Sets gain for slip compensation (in %).
• A squirrel-cage motor slips under load. Increasing the frequency as the motor torque increases compensates for the slip.
• Requires parameter 9904 MOTOR CTRL MODE = SCALAR.
0 = No slip compensation.
1…100 = Increasing slip compensation. 100% means full slip compensation.</td></tr>
</table>

Group 30: Fault Functions

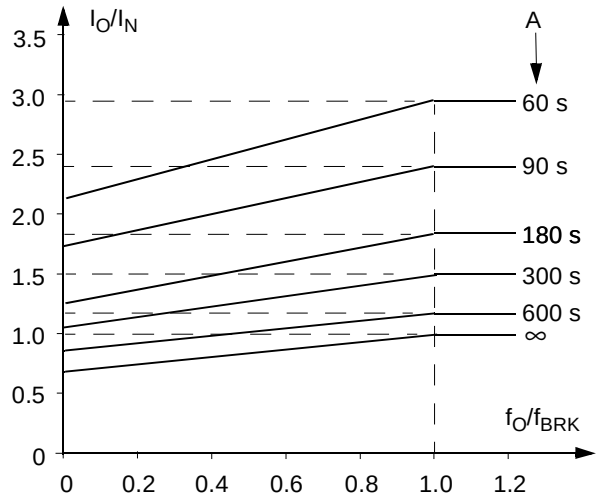
This group defines situations that the drive should recognize as potential faults and defines how the drive should respond if the fault is detected.

Code	Description
3001	**AI<MIN FUNCTION** Defines the drive response if the analog input (AI) signal drops below the fault limits and AI is used in reference chain). • 3021 AI1 FAULT LIMIT and 3022 AI2 FAULT LIMIT set the minimum limits 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (AI<MIN) and the drive coasts to stop. 2 = CONST SP 7 – Displays a warning (AI<MIN) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays a warning (AI<MIN) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Warning! If you select const sp 7 or last speed, make sure that continued operation is safe when the analog input signal is lost.**
3002	**PANEL COMM ERR** Defines the drive response to a control panel communication error. 1 = FAULT – Displays a fault (PANEL LOSS) and the drive coasts to stop. 2 = CONST SP 7 – Displays a warning (PANEL LOSS) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays a warning (PANEL LOSS) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Warning! If you select const sp 7 or last speed, make sure that continued operation is safe when the control panel communication is lost.**
3003	**EXTERNAL FAULT 1** Defines the External Fault 1 signal input and the drive response to an external fault. 0 = NOT SEL – External fault signal is not used. 1 = DI1 – Defines digital input DI1 as the external fault input. • Activating the digital input indicates a fault. The drive displays a fault (EXTERNAL FAULT 1) and the drive coasts to stop. 2...6 = DI2…DI6 – Defines digital input DI2…DI6 as the external fault input. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the external fault input. • De-activating the digital input indicates a fault. The drive displays a fault (EXTERNAL FAULT 1) and the drive coasts to stop. -2...-6 = DI2(INV)...DI6(INV) – Defines an inverted digital input DI2…DI6 as the external fault input. • See DI1(INV) above.
3004	**EXTERNAL FAULT 2** Defines the External Fault 2 signal input and the drive response to an external fault. • See parameter 3003 above.
3005	**MOT THERM PROT** Defines the drive response to motor overheating. 0 = NOT SEL – No response and/or motor thermal protection not set up. 1 = FAULT – When the calculated motor temperature exceeds 90 C, displays a warning (MOT OVERTEMP). When the calculated motor temperature exceeds 110 C displays a fault (MOT OVERTEMP) and the drive coasts to stop. 2 = WARNING – When the calculated motor temperature exceeds 90 C, displays a warning (MOT OVERTEMP).
3006	**MOT THERM TIME** Sets the motor thermal time constant for the motor temperature model. • This is the time required for the motor to reach 63% of the final temperature with steady load. • For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: MOTOR THERM TIME equals 35 times t6, where t6 (in seconds) is specified by the motor manufacturer as the time that the motor can safely operate at six times its rated current. • The thermal time for a Class 10 trip curve is 350 s, for a Class 20 trip curve 700 s, and for a Class 30 trip curve 1050 s. 

Code	Description
3007	**MOT LOAD CURVE** Sets the maximum allowable operating load of the motor. • When set to 100%, the maximum allowable load is equal to the value of Start-up Data parameter 9906 MOTOR NOM CURRENT. • Adjust the load curve level if the ambient temperature differs from nominal.
3008	**ZERO SPEED LOAD** Sets the maximum allowable current at zero speed. • Value is relative to 9906 MOTOR NOM CURR.
3009	**BREAK POINT FREQ** Sets the break point frequency for the motor load curve.

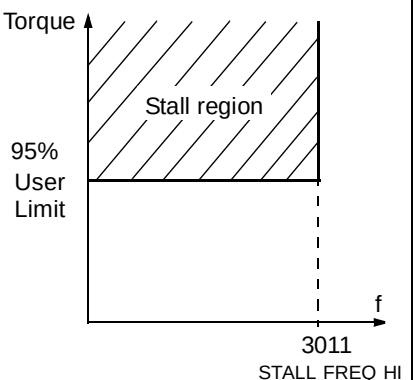


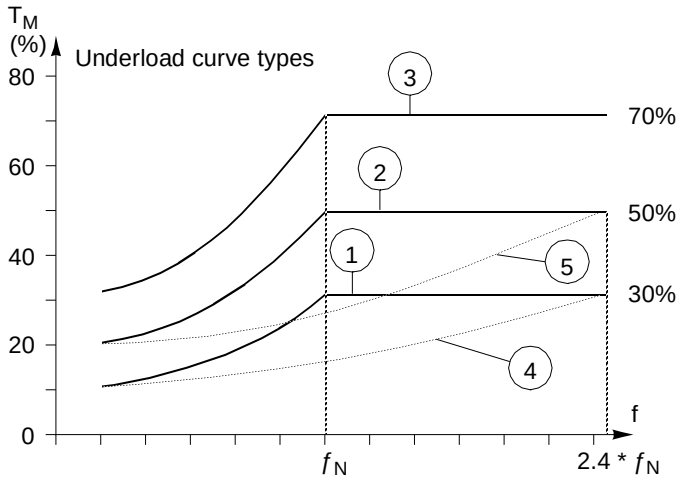
Example: Thermal protection trip times when parameters 3005 MOT THERM TIME, 3006 MOT LOAD CURVE and 3007 ZERO SPEED LOAD have default values.



I_O = Output current
I_N = Nominal motor current
f_O = Output frequency
f_{BRK} = Break point frequency
A = Trip time

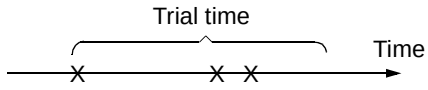
3010	**STALL FUNCTION** This parameter defines the operation of the Stall function. This protection is active if the drive operates in the stall region (see figure) for the time defined by 3012 STALL TIME. The "User Limit" is defined in Group 20 by 2017 MAX TORQUE 1, 2018 MAX TORQUE 2, or the limit on the COMM input. 0 = NOT SEL – Stall protection is not used. 1 = FAULT – When the drive operates in the stall region for the time set by 3012 STALL TIME: • The drive coasts to stop. • A fault indication is displayed. 2 = WARNING – When the drive operates in the stall region for the time set by 3012 STALL TIME: • A warning indication is displayed. • The warning disappears when the drive is out of the stall region for half the time set by parameter 3012 STALL TIME.
3011	**STALL FREQUENCY** This parameter sets the frequency value for the Stall function. Refer to Figure.
3012	**STALL TIME** This parameter sets the time value for the Stall function.



Code	Description
3013	**UNDERLOAD FUNCTION** Removal of motor load may indicate a process malfunction. The protection is activated if: • The motor torque drops below the load curve selected by parameter 3015 UNDERLOAD CURVE. • This condition has lasted longer than the time set by parameter 3014 UNDERLOAD TIME. • Output frequency is higher than 10% of the nominal frequency. 0 = NOT SEL – Underload protection is not used. 1 = FAULT – When the protection is activated the drive coasts to stop. A fault indication is displayed. 2 = WARNING – A warning indication is displayed.
3014	**UNDERLOAD TIME** Time limit for underload protection.
3015	**UNDERLOAD CURVE** This parameter provides five selectable curves shown in the figure. • If the load drops below the set curve for longer than the time set by parameter 3014, the underload protection is activated. • Curves 1...3 reach maximum at the motor rated frequency set by parameter 9907 MOTOR NOM FREQ. • T_M = nominal torque of the motor. • f_N = nominal frequency of the motor. 
3018	**COMM FAULT FUNC** Defines the drive response if the fieldbus communication is lost. 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (IO COMM ERROR) and the drive coasts to stop. 2 = CONST SP7 – Displays a warning (IO COMM ERROR) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays a warning (IO COMM ERROR) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Warning! If you select const speed 7, or last speed, make sure that continued operation is safe when fieldbus communication is lost.**
3019	**COMM FAULT TIME** Sets the communication fault time used with 3018 COMM FAULT FUNC. • Brief interruptions in the fieldbus communication are not treated as faults if they are less than the COMM FAULT TIME value.
3021	**AI1 FAULT LIMIT** Sets a fault level for analog input 1. See 3001 AI<MIN FUNCTION.
3022	**AI2 FAULT LIMIT** Sets a fault level for analog input 2. See 3001 AI<MIN FUNCTION.

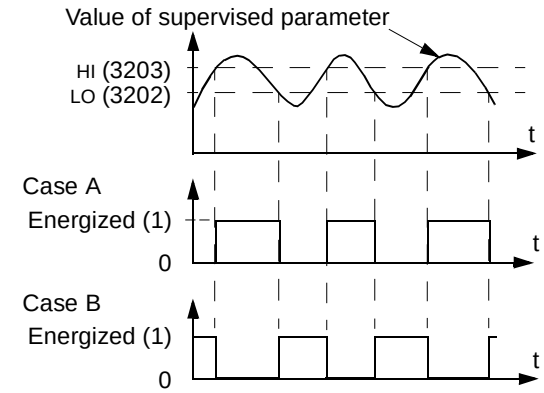
Group 31: Automatic Reset

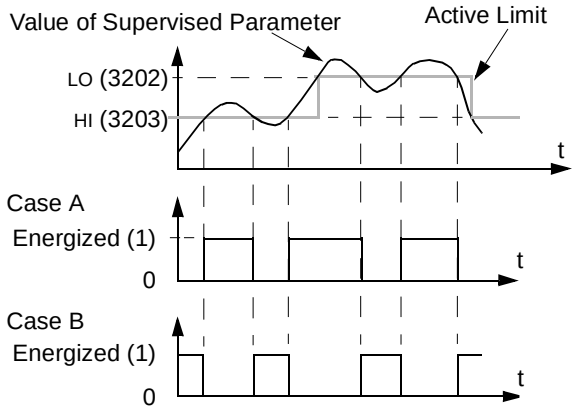
This group defines conditions for automatic resets. An automatic reset occurs after a particular fault is detected. The drive holds for a set delay time, then automatically restarts. You can limit the number of resets in a specified time period, and you can set up automatic resets for a variety of faults.

Code	Description	
3101	**NR OF TRIALS** Sets the number of allowed automatic resets within a trial period defined by 3102 TRIAL TIME. • If the number of automatic resets exceeds this limit (within the trial time), the drive prevents additional automatic resets and remains stopped. • Starting then requires a successful reset performed from the control panel or from a source selected by 1604 FAULT RESET SEL.	**Example:** Three faults have occurred in the trial time. The last is reset only if the value for 3101 NR OF TRIALS is 3 or more.  x = Automatic reset
3102	**TRIAL TIME** Sets the time period used for counting and limiting the number of resets. • See 3101 NR OF TRIALS.	
3103	**DELAY TIME** Sets the delay time between a fault detection and attempted drive restart. • If DELAY TIME = zero, the drive resets immediately.	
3104	**AR OVERCURRENT** Sets the automatic reset for the overcurrent function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (OVERCURRENT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3105	**AR OVERVOLTAGE** Sets the automatic reset for the overvoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC OVERVOLT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3106	**AR UNDERVOLTAGE** Sets the automatic reset for the undervoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC UNDERVOLTAGE) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3107	**AR AI<MIN** Sets the automatic reset for the analog input less than minimum value function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (AI<MIN) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation. **Warning! When the analog input signal is restored, the drive may restart, even after a long stop. Make sure that automatic, long delayed starts will not cause physical injury and/or damage equipment.**	
3108	**AR EXTERNAL FAULT** Sets the automatic reset for external faults function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (EXTERNAL FAULT 1 or EXTERNAL FAULT 2) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	

Group 32: Supervision

This group defines supervision for up to three signals from Group 01, Operating Data. Supervision monitors a specified parameter and energizes a relay output if the parameter passes a defined limit. Use Group 14, Relay Outputs, to define the relay and whether the relay activates when the signal is too low or too high.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>3201</td><td>SUPERV 1 PARAM
Selects the first supervised parameter.
• Must be a parameter number from Group 01 Operating Data.
• If the supervised parameter passes a limit, a relay output is energized.
• The supervision limits are defined in this group.
• The relay outputs are defined in Group 14 Relay Outputs (definition also specifies which supervision limit is monitored).
LO ≤ HI
Operating data supervision using relay outputs, when LO≤HI.
• Case A = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 OVER or SUPRV 2 OVER. Use for monitoring when/if the supervised signal exceeds a given limit. The relay remains active until the supervised value drops below the low limit.
• Case B = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV 1 UNDER or SUPRV 2 UNDER. Use for monitoring when/if the supervised signal falls below a given limit. The relay remains active until the supervised value rises above the high limit.
LO > HI
Operating data supervision using relay outputs, when LO>HI.
The lowest limit (HI 3203) is active initially, and remains active until the supervised parameter goes above the highest limit (LO 3202), making that limit the active limit. That limit remains active until the supervised parameter goes below the lowest limit (HI 3203), making that limit active.
• Case A = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 OVER or SUPRV2 OVER. Initially the relay is de-energized. It is energized whenever the supervised parameter goes above the active limit.
• Case B = Parameter 1402 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 UNDER or SUPRV2 UNDER. Initially the relay is energized. It is de-energized whenever the supervised parameter goes below the active limit.
LO ≤ HI
Note! Case LO ≤ HI represents a normal hysteresis.
 

LO > HI
Note! Case LO>HI represents a special hysteresis with two separate supervision limits.
 
</td></tr>
<tr><td>3202</td><td>SUPERV 1 LIM LO
Sets the low limit for the first supervised parameter. See 3201 SUPERV 1 PARAM above.</td></tr>
<tr><td>3203</td><td>SUPERV 1 LIM HI
Sets the high limit for the first supervised parameter. See 3201 SUPERV 1 PARAM above.</td></tr>
<tr><td>3204</td><td colspan="2">SUPERV 2 PARAM
Selects the second supervised parameter. See 3201 SUPERV 1 PARAM above.</td></tr>
<tr><td>3205</td><td colspan="2">SUPERV 2 LIM LO
Sets the low limit for the second supervised parameter. See 3204 SUPERV 2 PARAM above.</td></tr>
<tr><td>3206</td><td colspan="2">SUPERV 2 LIM HI
Sets the high limit for the second supervised parameter. See 3204 SUPERV 2 PARAM above.</td></tr>
<tr><td>3207</td><td colspan="2">SUPERV 3 PARAM
Selects the third supervised parameter. See 3201 SUPERV 1 PARAM above.</td></tr>
</table>

Code	Description
3208	**SUPERV 3 LIM LO** Sets the low limit for the second supervised parameter. See 3207 SUPERV 3 PARAM above.
3209	**SUPERV 3 LIM HI** Sets the high limit for the third supervised parameter. See 3207 SUPERV 3 PARAM above.

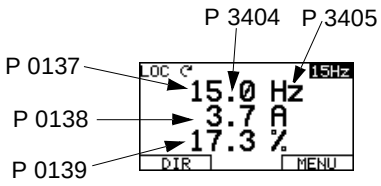
Group 33: Information

This group provides access to information about the drive's current programs: versions and test date.

Code	Description
3301	**FW VERSION** Contains the version of the drive's firmware.
3302	**LP VERSION** Contains the version of the loading package.
3303	**TEST DATE** Contains the test date (yy.ww).

Group 34: Panel Display Process Variables

This group defines the content for control panel display (middle area), when the control panel is in the control mode.

Code	Description
3401	**SIGNAL1 PARAM** Selects the first parameter (by number) displayed on the control panel. • Definitions in this group define display content when the control panel is in the control mode. • Any parameter number can be selected. • The figure identifies selections made by parameters in this group. 
3402	**SIGNAL1 MIN** Defines the minimum expected value for the first display parameter.
3403	**SIGNAL1 MAX** Defines the maximum expected value for the first display parameter.
3404	**OUTPUT1 DSP FORM** Defines the decimal point location for the first display parameter. • Enter the number of digits desired to the right of the decimal point. • See table for example using pi (3.14159).

3404 Value	Display	Range
0	± 3	-32768…+32767 (Signed)
1	± 3.1	
2	± 3.14	
3	± 3.142	
4	3	0…65535 (Unsigned)
5	3.1	
6	3.14	
7	3.142	

Code	Description
3405	**OUTPUT1 DSP UNIT** Selects the units used with the first display parameter. • Enter positive values in parameter 3405 for a numeric display. • Enter negative values in parameter 3405 for a bar-graph display.

0 = NOT SEL	8 = kh	16 = °F	24 = GPM	32 = kHz	40 = m^3/m	48 = gal/m	56 = FPS
1 = A	9 = °C	17 = hp	25 = PSI	33 = Ohm	41 = kg/s	49 = gal/h	57 = ft/s
2 = V	10 = lb ft	18 = MWh	26 = CFM	34 = ppm	42 = kg/m	50 = ft^3/s	58 = inH_2O
3 = Hz	11 = mA	19 = m/s	27 = ft	35 = pps	43 = kg/h	51 = ft^3/m	59 = in wg
4 = %	12 = mV	20 = m^3/h	28 = MGD	36 = l/s	44 = mbar	52 = ft^3/h	60 = ft wg
5 = s	13 = kW	21 = dm^3/s	29 = inHg	37 = l/min	45 = Pa	53 = lb/s	61 = lbsi
6 = h	14 = W	22 = bar	30 = FPM	38 = l/h	46 = GPS	54 = lb/m	62 = ms
7 = rpm	15 = kWh	23 = kPa	31 = kb/s	39 = m^3/s	47 = gal/s	55 = lb/h	63 = Mrev

122...127 = Cst

Additional bar display units

-123 =Iout -124 = Vout -125 = Fout -126 = Tout -127 = Vdc

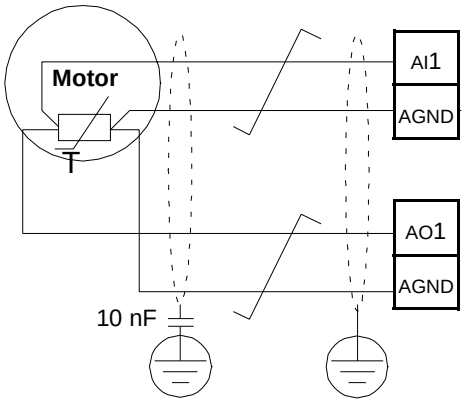
3406	**OUTPUT1 MIN** Sets the minimum value displayed for the first display parameter.
3407	**OUTPUT1 MAX** Sets the maximum value displayed for the first display parameter.
3408	**SIGNAL 2 PARAM** Selects the second parameter (by number) displayed on the control panel. See parameter 3401.
3409	**SIGNAL 2 MIN** Defines the minimum expected value for the second display parameter. See parameter 3402.
3410	**SIGNAL 2 MAX** Defines the maximum expected value for the second display parameter. See parameter 3403.

Code	Description
3411	**OUTPUT 2 DSP FORM** Defines the decimal point location for the second display parameter. See parameter 3404.
3412	**OUTPUT 2 DSP UNIT** Selects the units used with the second display parameter. See parameter 3405.
3413	**OUTPUT 2 MIN** Sets the minimum value displayed for the second display parameter. See parameter 3406.
3414	**OUTPUT 2 MAX** Sets the maximum value displayed for the second display parameter. See parameter 3407.
3415	**SIGNAL 3 PARAM** Selects the third parameter (by number) displayed on the control panel. See parameter 3401.
3416	**SIGNAL 3 MIN** Defines the minimum expected value for the third display parameter. See parameter 3402.
3417	**SIGNAL 3 MAX** Defines the maximum expected value for the third display parameter. See parameter 3403.
3418	**OUTPUT 3 DSP FORM** Defines the decimal point location for the third display parameter. See parameter 3404.
3418	**OUTPUT 3 DSP UNIT** Selects the units used with the third display parameter. See parameter 3405.
3420	**OUTPUT 3 MIN** Sets the minimum value displayed for the third display parameter. See parameter 3406.
3421	**OUTPUT 3 MAX** Sets the maximum value displayed for the third display parameter. See parameter 3407.

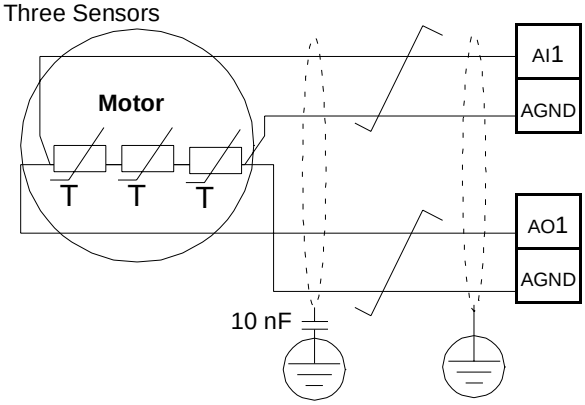
Group 35: Motor Temp Meas

This group defines the detection and reporting for a particular potential fault – motor overheating, as detected by a temperature sensor. Typical connections are defined below.

One Sensor



Three Sensors



Warning! IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, connect a thermistor (and other similar components) to the drive's control terminals using any of these alternatives:

- **Separate the thermistor from live parts of the motor with double reinforced insulation.**
- **Protect all circuits connected to the drive's digital and analog inputs. Protect against contact, and insulate from other low voltage circuits with basic insulation (rated for the same voltage level as the drive's main circuit).**
- **Use an external thermistor relay. The relay insulation must be rated for the same voltage level as the drive's main circuit.**

For other faults, or for anticipating motor overheating using a model, see Group 30: Fault Functions.

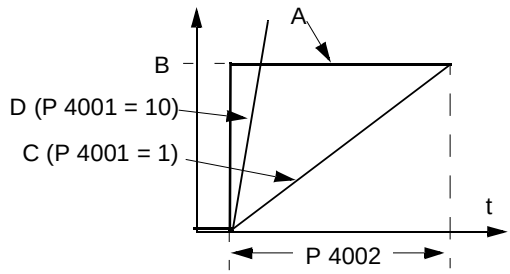
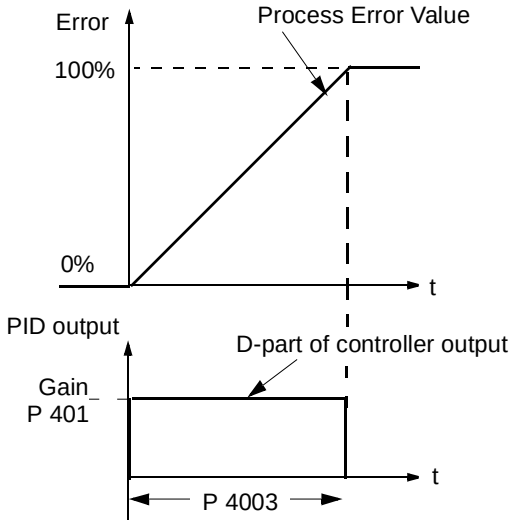
Code	Description
3501	**SENSOR TYPE** Identifies the type of motor temperature sensor used, PT100 (°C) or PTC (ohms). See parameters 1501 and 1507. 0 = NONE 1 = 1 x PT100 – Sensor configuration uses one PT 100 sensor. • Analog output AO1 or AO2 feeds constant current through the sensor. • The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. • The temperature measurement function reads the voltage through analog input AI1 or AI2 and converts it to degrees centigrade. 2 = 2 x PT100 – Sensor configuration uses two PT 100 sensors. • Operation is the same as for above 1 x PT100. 3 = 3 x PT100 – Sensor configuration uses three PT 100 sensors. • Operation is the same as for above 1 x PT100. 4 = PTC – Sensor configuration uses one PTC. • The analog output feeds a constant current through the sensor. • The resistance of the sensor increases sharply as the motor temperature rises over the PTC reference temperature (T_{ref}), as does the voltage over the resistor. The temperature measurement function reads the voltage through analog input AI1 and converts it into ohms. • The figure shows typical PTC sensor resistance values as a function of the motor operating temperature. Ohm 4000 1330 550 100 T **Temperature** / **Resistance** Normal: 0 … 1.5 kohm Excessive: ≥ 4 kohm
3502	**INPUT SELECTION** Defines the analog input used for the temperature sensor. 1 = AI1 2 = AI2
3503	**ALARM LIMIT** Defines the alarm limit for motor temperature measurement. • At motor temperatures above this limit, the drive displays an alarm (MOTOR OVERTEMP)
3504	**FAULT LIMIT** Defines the fault limit for motor temperature measurement. • At motor temperatures above this limit, the drive displays a fault (MOTOR OVERTEMP) and stops the drive.

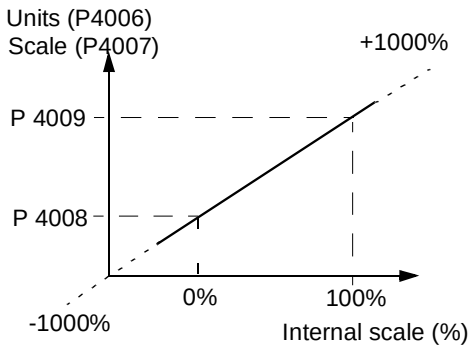
Group 40: Process PID Set 1

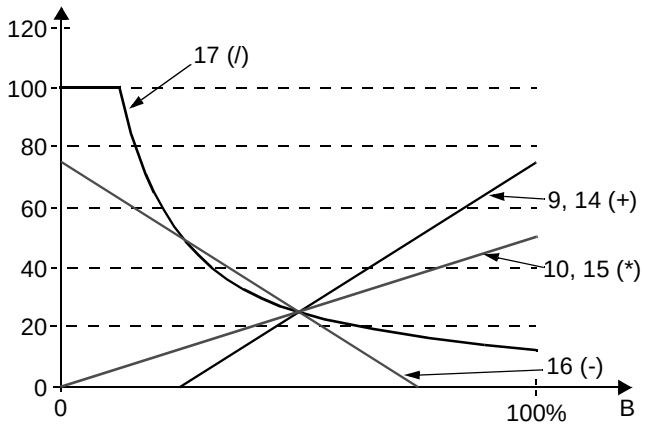
This group defines a process PID control operation mode for the drive. In PID control mode, the drive compares a reference signal (setpoint) to an actual signal (feedback), and automatically adjusts the speed of the drive to match the two signals. The difference between the two signals is the error value.

Three groups of parameters define PID control:

- Group 40 Process PID Set 1 defines process PID Set 1. Normally, this parameter set is used.
- Group 41 Process PID Set 2 defines process PID Set 2.
  Both Group 40 and 41 have the same parameters, except for the parameter used to select the PID set (4027).
- Group 42 External / Trimming PID defines:
  - an external PID control parameters or
  - trimming input parameters for speed /frequency reference.

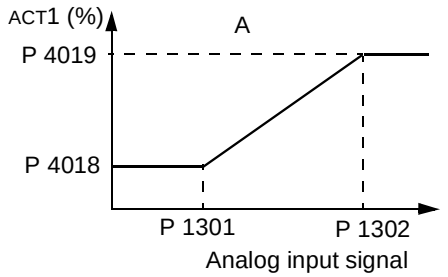
Code	Description
4001	**GAIN** Defines the PID Controller's gain. • The setting range is 0.1... 100. • At 0.1, the PID Controller output changes one-tenth as much as the error value. • At 100, the PID Controller output changes one hundred times as much as the error value.
4002	**INTEGRATION TIME** Defines the PID Controller's integration time. Integration time is, by definition, is the time required to increase the output by the error value: • Error value is constant and 100%. • Gain = 1. • Integration time of 1 second denotes that a 100% change is achieved in 1 second. 0.0 = NOT SEL – Disables integration (I-part of controller). 0.1…600.0 = Integration time (seconds).  A = Error B = Error value after stop C = Controller output with Gain = 1 D = Controller output with Gain = 10
4003	**DERIVATION TIME** Defines the PID Controller's derivation time. • You can add the derivative of the error to the PID controller output. The derivative is the error value's rate of change. For example, if the process error value changes linearly, the derivative is a constant added to the PID controller output. • The error-derivative is filtered with a 1-pole filter. The time constant of the filter is defined by parameter 4004 PID DERIV FILTER. 0.0 = NOT SEL – Disables the error-derivative part of the PID controller output 0.1…10.0 = Derivation time (seconds) 

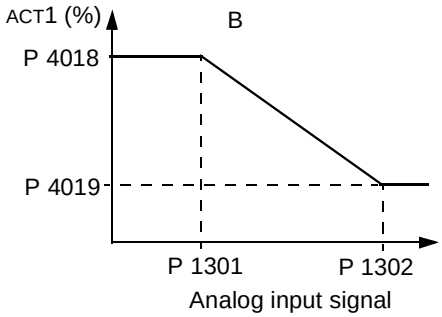
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>4004</td><td>PID DERIV FILTER
Defines the filter time constant for the error-derivative part of the PID controller output.
• Before being added to the PID controller output, the error-derivative is filtered with a 1-pole filter.
• Increasing the filter time smooths the error-derivative, reducing noise.
0.0 = NOT SEL – Disables the error-derivative filter.
0.1…10.0 = Filter time constant (seconds).</td></tr>
<tr><td>4005</td><td>ERROR VALUE INV
Selects either a normal or inverted relationship between the feedback signal and the drive speed.
0 = NO – Normal, a decrease in feedback signal increases drive speed. Error = Ref - Fbk
1 = YES – Inverted, a decrease in feedback signal decreases drive speed. Error = Fbk - Ref</td></tr>
<tr><td>4006</td><td>UNIT
Selects the unit for the PID controller actual values. (PID1 parameters 0128, 0130, and 0132).
• See parameter 3405 for list of available units.</td></tr>
<tr><td>4007</td><td>DSP FORMAT
Defines the decimal point location in PID controller actual values.
• Enter the decimal point location counting in from the right of the entry.
• See table for example using pi (3.14259).
<table><tr><th>4007 Value</th><th>Entry</th><th>Display</th></tr><tr><td>0</td><td>0003</td><td>3</td></tr><tr><td>1</td><td>0031</td><td>3.1</td></tr><tr><td>2</td><td>0314</td><td>3.14</td></tr><tr><td>3</td><td>3142</td><td>3.142</td></tr></table></td></tr>
<tr><td>4008</td><td>0 % VALUE
Defines (together with the next parameter) the scaling applied to the PID controller's actual values (PID1 parameters 0128, 0130, and 0132).
• Units and scale are defined by parameters 4006 and 4007.</td></tr>
<tr><td>4009</td><td>100 % VALUE
Defines (together with the previous parameter) the scaling applied to the PID controller's actual values.
• Units and scale are defined by parameters 4006 and 4007.</td></tr>
<tr><td colspan="2"> 
</td></tr>
</table>

Code	Description
4010	**SET POINT SEL** Defines the reference signal source for the PID controller. • Parameter has no significance when the PID regulator is by-passed (see 8121 REG BYPASS CTRL). 0 = keypad – Control panel provides reference. 1 = AI1 – Analog input 1 provides reference. 2 = AI2 – Analog input 2 provides reference. 8 = comm – Fieldbus provides reference. 9 = COMM + AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below. 10 = COMM * AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below. 11 = DI3U, 4D(RNC) – Digital inputs, acting as a motor potentiometer control, provide reference. • DI3 increases the speed (the U stands for "up") • DI4 decreases the reference (the D stands for "down"). • Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change. • R = Stop command resets the reference to zero. • NC = Reference value is not copied. 12 = DI3U, 4D(NC) – Same as DI3U, 4D(RNC) above, except: • Stop command does not reset reference to zero. At restart the motor ramps up, at the selected acceleration rate, to the stored reference. 13 = DI5U, 6D(NC) – Same as DI3U, 4D(NC) above, except: • Uses digital inputs DI5 and DI6. 14 = AI1 + AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 15 = AI1 * AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 16 = AI1 - AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 19 = INTERNAL – A constant value set using parameter 4011 provides reference.
	Analog Input Reference Correction Parameter values 9, 10, and 14…17 use the formulae in the following table. **Value Setting** / **AI reference is calculated as following:** C + B: C value + (B value - 50% of reference value) C * B: C value * (B value / 50% of reference value) C - B: (C value + 50% of reference value) - B value C / B: (C value * 50% of reference value) / B value Where: • C = Main Reference value (= COMM for values 9, 10 and = AI1 for values 14…17). • B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17). **Example:** The figure shows the reference source curves for value settings 9, 10, and 14…17, where: • C = 25%. • P 4012 SETPOINT MIN = 0. • P 4013 SETPOINT MAX = 0. • B varies along the horizontal axis. 
4011	**INTERNAL SETPNT** Sets a constant value used for the process reference. • Units and scale are defined by parameters 4006 and 4007.

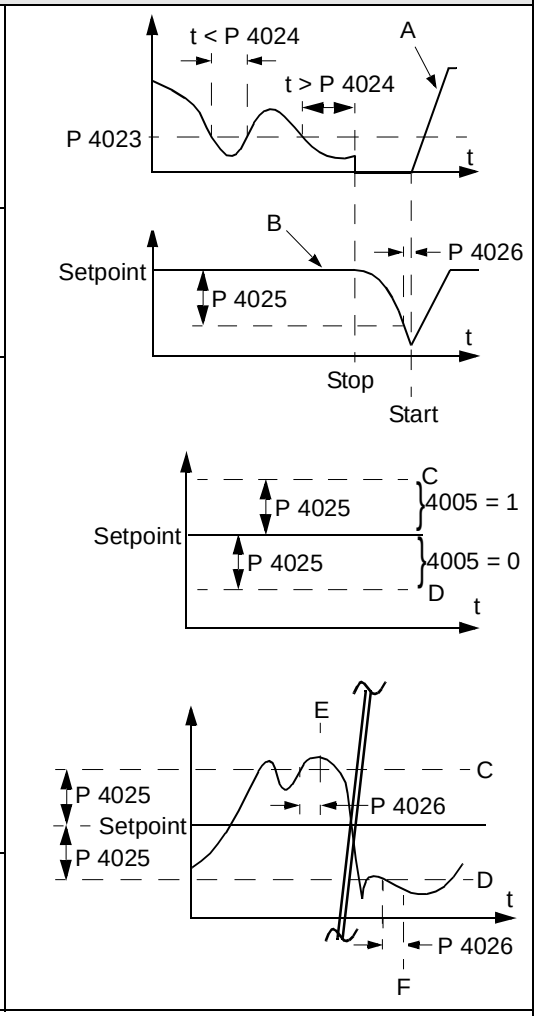
Code	Description
4012	**SETPOINT MIN** Sets the minimum value for the reference signal source. See parameter 4010.
4013	**SETPOINT MAX** Sets the maximum value for the reference signal source. See parameter 4010.
4014	**FBK SEL** Defines the PID controller feedback (actual signal). • You can define a combination of two actual values (ACT1 and ACT2) as the feedback signal. • Use parameter 4016 to define the source for actual value 1 (ACT1). • Use parameter 4017 to define the source for actual value 2 (ACT2). 1 = ACT1 – Actual value 1 (ACT1) provides the feedback signal. 2 = ACT1-ACT2 – ACT1 minus ACT2 provides the feedback signal. 3 = ACT1+ACT2 – ACT1 plus ACT2 provides the feedback signal. 4 = ACT1*ACT2 – ACT1 times ACT2 provides the feedback signal. 5 = ACT1/ACT2 – ACT1 divided by ACT2 provides the feedback signal. 6 = MIN (A1, A2) – The smaller of ACT1 or ACT2 provides the feedback signal. 7 = MAX (A1, A2) – The greater of ACT1 or ACT2 provides the feedback signal. 8 = SQRT (A1-A2) – Square root of the value for ACT1 minus ACT2 provides the feedback signal. 9 = SQA1 + SQA2 – Square root of ACT1 plus the square root of ACT2 provides the feedback signal.
4015	**FBK MULTIPLIER** Defines an extra multiplier for the PID FBK value defined by parameter 4014. • Used mainly in applications where the flow is calculated from the pressure difference. 0 = NOT USED. -32768…32767 = Multiplier applied to the signal defined by parameter 4014 FBK SEL. **Example:** $\mathrm{FBK} = \mathrm{Multiplier} \times \sqrt{\mathrm{A1} - \mathrm{A2}}$
4016	**ACT1 INPUT** Defines the source for actual value 1 (ACT1). 0 = AI 1 – Uses analog input 1 for ACT1. 1 = AI 2 – Uses analog input 2 for ACT1. 2 = Current – Uses current for ACT1, scaled so: • Min ACT1 = 0 current • Max ACT1 = 2 x nominal current 3 = Torque – Uses torque for ACT1, scaled so: • Min ACT1 = -2 x nominal torque • Max ACT1 = 2 x nominal torque 4 = Power – Uses power for ACT1, scaled so: • Min ACT1 = -2 x nominal power • Max ACT1 = 2 x nominal power
4017	**ACT2 INPUT** Defines the source for actual value 2 (ACT2). 0 = AI 1 – Uses analog input 1 for ACT2. 1 = AI 2 – Uses analog input 2 for ACT2. 2 = Current – Uses current for ACT2, scaled so: • Min ACT2 = 0 current • Max ACT2 = 2 x nominal current 3 = Torque – Uses torque for ACT2, scaled so: • Min ACT2 = -2 x nominal torque • Max ACT2 = 2 x nominal torque 4 = Power – Uses power for ACT2, scaled so: • Min ACT2 = -2 x nominal power • Max ACT2 = 2 x nominal power

Code	Description
4018	**ACT1 MINIMUM** Sets the minimum value for ACT1. • Used with analog input min/max settings (e.g. 1301 MINIMUM AI1, 1302 MAXIMUM AI1). • Scales analog inputs used as actual values. • See figure: A= Normal; B = Inversion (ACT1 MINIMUM > ACT1 MAXIMUM)
4019	**ACT1 MAXIMUM** Sets the maximum value for ACT1. • See 4018 ACT1 MINIMUM.
4020	**ACT2 MINIMUM** Sets the minimum value for ACT2. • See 4018 ACT1 MINIMUM.
4021	**ACT2 MAXIMUM** Sets the maximum value for ACT2. • See 4018 ACT1 MINIMUM.
4022	**SLEEP SELECTION** Defines the control for the PID sleep function. 0 = NOT SEL– Disables the PID sleep control function. 1 = DI1 – Defines digital input DI1 as the control for the PID sleep function. • Activating the digital input activates the sleep function. • De-activating the digital input restores PID control. 2...6 = DI2...DI6 – Defines digital input DI2…DI6 as the control for the PID sleep function. • See DI1 above. 7 = INTERNAL – Defines the output frequency, process reference, and process actual value as the control for the PID sleep function. Refer to parameters 4025 WAKE-UP DEV and 4023 PID SLEEP LEVEL. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for the PID sleep function. • De-activating the digital input activates the sleep function. • Activating the digital input restores PID control. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for the PID sleep function. • See DI1(INV) above.





Code	Description
4023	**PID SLEEP LEVEL** Sets the motor speed / frequency that enables the PID sleep function – a motor speed / frequency below this level, for at least the time period 4024 PID SLEEP DELAY enables the PID sleep function (stopping the drive). • Requires 4022 = 7 INTERNAL. • See figure: A = PID output level; B = PID process feedback.
4024	**PID SLEEP DELAY** Sets the time delay for the PID sleep function – a motor speed / frequency below 4023 PID SLEEP LEVEL for at least this time period enables the PID sleep function (stopping the drive). • See 4023 PID SLEEP LEVEL above.
4025	**WAKE-UP DEVIATION** Defines the wake-up deviation – a deviation from the setpoint greater than this value, for at least the time period 4026 WAKE-UP DELAY, re-starts the PID controller. • Parameters 4006 and 4007 define the units and scale. • Parameter 4005 = 0, Wake-up level = Setpoint - Wake-up deviation. • Parameter 4005 = 1, Wake-up level = Setpoint + Wake-up deviation. • Wake-up level can be above or below setpoint. • See 4023 PID SLEEP LEVEL above. See figures: • C = Wake-up level when parameter 4005 = 1 • D = Wake-up level when parameter 4005 = 0 • E = Feedback is above wake-up level and lasts longer than 4026 WAKE-UP DELAY – PID function wakes up. • F = Feedback is below wake-up level and lasts longer than 4026 WAKE-UP DELAY – PID function wakes up.
4026	**WAKE-UP DELAY** Defines the wake-up delay – a deviation from the setpoint greater than 4025 WAKE-UP DEVIATION, for at least this time period, re-starts the PID controller. • See 4023 PID SLEEP LEVEL above.



4027	**PID 1 PARAM SET** Defines how selections are made between PID Set 1 and PID Set 2. PID parameter set selection. When set 1 is selected, parameters 4001…4026 are used. When set 2 is selected, parameters 4101…4126 are used. 0 = SET 1 – PID Set 1 (parameters 4001…4026) is active. 1 = DI1 – Defines digital input DI1 as the control for PID Set selection. • Activating the digital input selects PID Set 2. • De-activating the digital input selects PID Set 1. 2...6 = DI2...DI6 – Defines digital input DI2…DI6 as the control for PID Set selection. • See DI1 above. 7 = SET 2 – PID Set 2 (parameters 4101…4126) is active. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for PID Set selection. • Activating the digital input selects PID Set 1. • De-activating the digital input selects PID Set 2. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for PID Set selection. • See DI1(INV) above.

Group 41: Process PID Set 2

Parameters of this group belong to PID parameter set 2. The operation of parameters 4101…4126 is analogous with set 1 parameters 4001…4026.

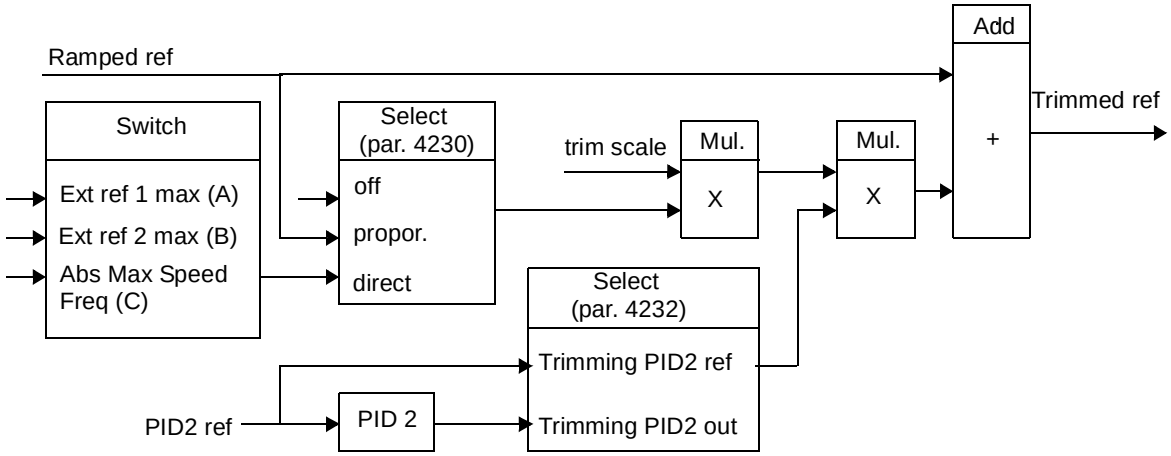
PID parameter set 2 can be selected by parameter 4027 PID 1 PARAM SET.

Group 42: External / Trimming PID

This group defines the parameters used for the External / Trimming PID.

The operation of parameters 4201...4221 is analogous with set 1 (and set 2) parameters 4001...4021 (4011...4021). The parameter groups 40 and 41 define the parameters for a process PID.

Code	Description
4228	**ACTIVATE** Defines the source for enabling the external PID function. • Requires 4230 TRIM MODE = 0 NOT SEL. 0 = NOT SEL – Disables external PID control. 1 = DI1 – Defines digital input DI1 as the control for enabling external PID control. • Activating the digital input enables external PID control. • De-activating the digital input disables external PID control. 2...6 = DI2...DI6 – Defines digital input DI2…DI6 as the control for enabling external PID control. • See DI1 above. 7 = DRIVE RUN – Defines the start command as the control for enabling external PID control. • Activating the start command (drive is running) enables external PID control. 8 = ON – Defines the power-on as the control for enabling external PID control. • Activating power to the drive enables external PID control. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for enabling external PID control. • Activating the digital input disables external PID control. • De-activating the digital input enables external PID control. -2...-6 = DI2(INV)...DI6(INV) – Defines digital input DI2…DI6 as the control for enabling external PID control. • See DI1(INV) above.
4229	**OFFSET** Defines the offset for the PID output. • When PID is activated, output starts from this value. • When PID is deactivated, output resets to this value. • Parameter is not active when 4230 TRIM MODE not = 0 (trim mode is active).
4230	**TRIM MODE** Selects the type of trim, if any. Using the trim it is possible to combine a corrective factor to the drive reference. 0 = NOT SEL – Disables the trim function. 1 = PROPORTIONAL – Adds a trim factor that is proportional to the rpm/Hz reference (external % - reference (REF2). See parameter 1106). 2 = DIRECT – Adds a trim factor based on the control loop's maximum limit.
4231	**TRIM SCALE** Defines the multiplier (as a percent, plus or minus) used in the trim mode.

Code	Description
4232	**CORRECTION SRC** Defines the trimming reference for the correction source. 1 = TRIMMING PID2 REF – Uses appropriate REF MAX (SWITCH A OR B): • 1105 REF 1 MAX when REF1 is active (A). • 1108 REF 2 MAX when REF2 is active (B). 2 = TRIMMING PID2 OUTPUT – Uses the absolute maximum speed or frequency (Switch C): • 2002 MAXIMUM SPEED if 9904 MOTOR CONTROL MODE = 1 SPEED or 2 TORQUE. • 2008 MAXIMUM FREQUENCY IF 9904 MOTOR CONTROL MODE = 3 SCALAR. 

Group 51: Ext Comm Module

This group defines set-up variables for an external fieldbus communication module. Refer to communication module documentation for more information on these parameters.

Code	Description
5101	**FBA TYPE** Displays the type of the connected fieldbus adapter module. 0 = Module not found or not connected. Check the fieldbus User's Manual chapter "Mechanical Installation" and check that parameter 9802 is set to 4 = EXT FBA. 1 = PROFIBUS-DP – 16 = INTERBUS – 21 = LONWORKS – 32 = CANOPEN – 37 = DEVICENET – 64 = MODBUS PLUS – 101 = CONTROLNET – 128 = ETHERNET –
5102 … 5126	**FB PAR 2…FB PAR 26** Refer to communication module documentation for more information on these parameters.
5127	**FBA PAR REFRESH** Validates any changed fieldbus parameter settings. • After refreshing, the value reverts automatically to DONE.
5128	**FILE CPI FW REV** Displays the CPI firmware revision of the drive's fieldbus adapter configuration file. Format is xyz where: • x = major revision number • y = minor revision number • z = correction number **Example:** 107 = revision 1.07
5129	**FILE CONFIG ID** Displays the revision of the drive's fieldbus adapter module's configuration file identification. • File configuration information is drive application program-dependent.
5130	**FILE CONFIG REV** Contains the revision of the drive's fieldbus adapter module configuration file. **Example:** 1 = revision 1
5131 0	**FBA STATUS** Contains the status of the adapter module. 0 = IDLE – Adapter not configured. 1 = EXEC. INIT – Adapter is initializing. 2 = TIME OUT – A timeout has occurred in the communication between the adapter and the drive. 3 = CONFIG ERROR – Adapter configuration error. • The major or minor revision code of the adapter's CPI firmware revision differs from that stated in the drive's configuration file. 4 = OFF-LINE – Adapter is off-line. 5 = ON-LINE – Adapter is on-line. 6 = RESET – Adapter is performing a hardware reset.
5132	**FBA CPI FW REV** Contains the revision of the module's CPI program. Format is xyz where: • x = major revision number • y = minor revision number • z = correction number **Example:** 107 = revision 1.07

Code	Description
5133	**FBA APPL FW REV** Contains the revision of the module's application program Format is xyz where: • x = major revision number • y = minor revision number • z = correction number **Example:** 107 = revision 1.07

Group 52: RS-232 / Panel

This group defines the settings required to connect the ACS550 to a Modbus fieldbus system. For example: station number, communication speed, and parity.

In this group, parameter modifications take effect on the next power-up.

Code	Description
5201	**STATION ID** Defines the address of the drive. • Two units with the same address are not allowed on-line. • Range: 1…247
5202	**BAUDRATE** Defines the communication speed of the drive in kbits per second (kbits/s). 9.6 19.2 38.4 57.6 115.2
5203	**PARITY** Sets the character format to be used with the panel communication. 0 = 8N1 – No parity, one stop bit. 1 = 8N2 – No parity, two stop bits. 2 = 8E1 – Even parity, one stop bit. 3 = 8O1 – Odd parity, one stop bit.
5204	**OK MESSAGES** Contains a count of valid Modbus messages received by the drive. • During normal operation, this counter is increasing constantly.
5205	**PARITY ERRORS** Contains a count of the characters with a parity error that is received from the bus. For high counts, check: • Parity settings of devices connected on the bus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.
5206	**FRAME ERRORS** Contains a count of the characters with a framing error that the bus receives. For high counts, check: • Communication speed settings of devices connected on the bus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.
5207	**BUFFER OVERRUNS** Contains a count of the characters received that cannot be placed in the buffer. • Longest possible message length for the drive is 32 bytes. • Received messages exceeding 32 bytes overflow the buffer. The excess characters are counted.
5208	**CRC ERRORS** Contains a count of the messages with a CRC error that the drive receives. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.

Group 53: EFB Protocol

This group defines set-up variables used for an embedded fieldbus (EFB) communication protocol. Refer to communication protocol documentation for more information on these parameters.

Code	Description
5301	**EFB PROTOCOL ID** Contains the identification and program revision of the protocol. • Format: XXYY, where xx = protocol ID, and YY = program revision.
5302	**EFB STATION ID** Defines the node address of the RS485 link. • The node address on each unit must be unique.
5303	**EFB BAUD RATE** Defines the communication speed of the RS485 link in kbits per second (kbits/s). 1.2 kbits/s 2.4 kbits/s 4.8 kbits/s 9.6 kbits/s 19.2 kbits/s 38.4 kbits/s 57.6 kbits/s
5304	**EFB PARITY** Defines the data length parity and stop bits to be used with the RS485 link communication. • The same settings must be used in all on-line stations. 0 = 8N1 – 8 data bits, No parity, one stop bit. 1 = 8N2 – 8 data bits, No parity, two stop bits. 2 = 8E1 – 8 data bits, Even parity, one stop bit. 3 = 8O1 – 8 data bits, Odd parity, one stop bit.
5305	**EFB CTRL PROFILE** Selects the communication profile used by the EFB protocol. 0 = ABB DRIVES – Operation of Control Word and Status Word conforms to ABB Drives Profile. 1 = ACS550
5306	**EFB OK MESSAGES** Contains a count of valid messages received by the drive. • During normal operation, this counter is increasing constantly.
5307	**EFB CRC ERRORS** Contains a count of the messages with a CRC error received by the drive. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.
5308	**EFB UART ERRORS** Contains a count of the messages with a character error received by the drive.
5309	**EFB STATUS** Contains the status of the EFB protocol. 0 = IDLE – EFB protocol is not configured. 1 = EXEC. INIT – EFB protocol is initializing. 2 = TIME OUT – A timeout has occurred in the communication between the network master and the EFB protocol. 3 = CONFIG ERROR – EFB protocol has a configuration error. 4 = OFF-LINE – EFB protocol is off-line. 5 = ON-LINE – EFB protocol is on-line. 6 = RESET – EFB protocol is performing a hardware reset. 7 = LISTEN ONLY – EFB protocol is in listen-only mode.
5310	**EFB PAR 10** Specifies the parameter mapped to Modbus Register 40005.
5311	**EFB PAR 11** Specifies the parameter mapped to Modbus Register 40006.

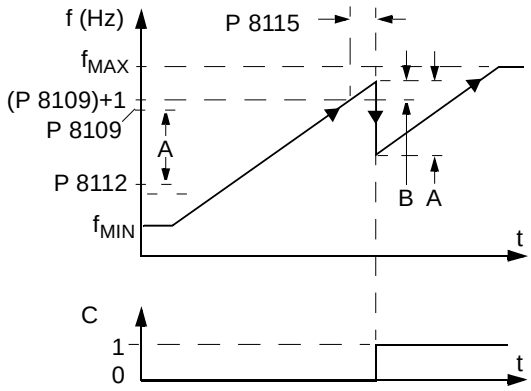
Code	Description
5312	**EFB PAR 12** Specifies the parameter mapped to Modbus Register 40007.
5313	**EFB PAR 13** Specifies the parameter mapped to Modbus Register 40008.
5314	**EFB PAR 14** Specifies the parameter mapped to Modbus Register 40009.
5315	**EFB PAR 15** Specifies the parameter mapped to Modbus Register 40010.
5316	**EFB PAR 16** Specifies the parameter mapped to Modbus Register 40011.
5317	**EFB PAR 17** Specifies the parameter mapped to Modbus Register 40012.

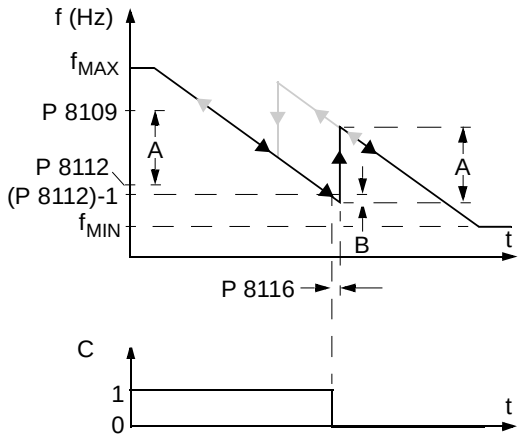
Group 81: PFC Control

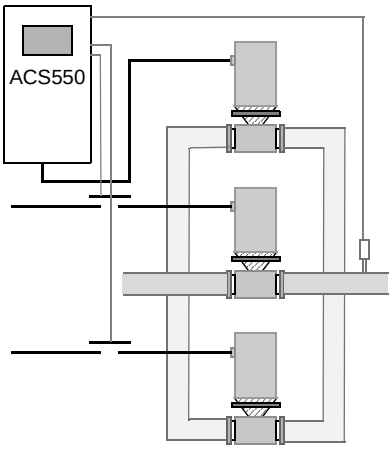
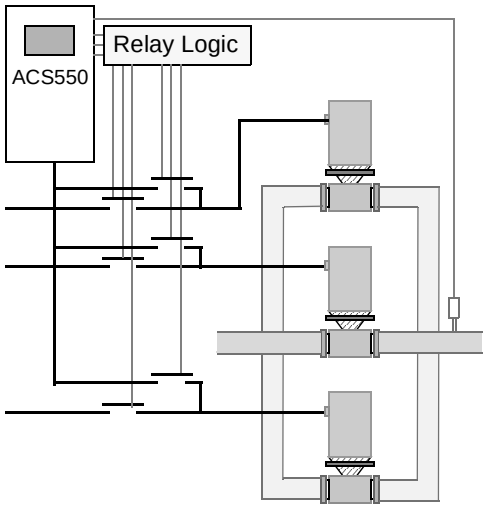
This group defines a Pump-Fan Control (PFC) mode of operation. The major features of PFC control are:

- The ACS550 controls the motor of pump no. 1, varying the motor speed to control the pump capacity. This motor is the speed regulated motor.
- Direct line connections power the motor of pump no. 2 and pump no.3, etc. The ACS550 switches pump no. 2 (and then pump no. 3, etc.) on and off as needed. These motors are auxiliary motors.
- The ACS550 PID control uses two signals: a process reference and an actual value feedback. The PID controller adjusts the speed (frequency) of the first pump such that the actual value follows the process reference.
- When demand (defined by the process reference) exceeds the first motor's capacity (user defined as a frequency limit), the PFC control automatically starts an auxiliary pump. The PFC also reduces the speed of the first pump to account for the auxiliary pump's addition to total output. Then, as before, the PID controller adjusts the speed (frequency) of the first pump such that the actual value follows the process reference. If demand continues to increase, PFC adds additional auxiliary pumps, using the same process.
- When demand drops, such that the first pump speed falls below a minimum limit (user defined by a frequency limit), the PFC control automatically stops an auxiliary pump. The PFC also increases the speed of the first pump to account for the auxiliary pump's missing output.
- An Interlock function (when enabled) identifies off-line (out of service) motors, and the PFC control skips to the next available motor in the sequence.
- An Autochange function (when enabled and with the appropriate switchgear) equalizes duty time between the pump motors. Autochange periodically increments the position of each motor in the rotation – the speed regulated motor becomes the last auxiliary motor, the first auxiliary motor becomes the speed regulated motor, etc.

Code	Description
8103	**REFERENCE STEP 1** Sets a percentage value that is added to the process reference. • Applies only when at least one auxiliary (constant speed) motor is running. • Default value is 0%. **Example:** An ACS550 operates three parallel pumps that maintain water pressure in a pipe. • 4011 INTERNAL SETPNT sets a constant pressure reference that controls the pressure in the pipe. • The speed regulated pump operates alone at low water consumption levels. • As water consumption increases, first one constant speed pump operates, then, the second. • As flow increases, the pressure at the output end of the pipe drops relative to the pressure measured at the input end. As auxiliary motors step in to increase the flow, the adjustments below correct the reference to more closely match the output pressure. • When the first auxiliary pump operates, increase the reference with parameter 8103 REFERENCE STEP 1. • When both auxiliary pumps operate, increase the reference with parameter 8103 reference step 1 + parameter 8104 reference step 2. • When three auxiliary pumps operate, increase the reference with parameter 8103 REFERENCE STEP 1 + parameter 8104 REFERENCE STEP 2 + parameter 8105 REFERENCE STEP 3.

Code	Description
8104	**REFERENCE STEP 2** Sets a percentage value that is added to the process reference. • Applies only when at least two auxiliary (constant speed) motors are running. • See parameter 8103 REFERENCE STEP1.
8105	**REFERENCE STEP 3** Sets a percentage value that is added to the process reference. • Applies only when at least three auxiliary (constant speed) motors are running. • See parameter 8103 REFERENCE STEP1.
8109	**START FREQ 1** Sets the frequency limit used to start the first auxiliary motor. The first auxiliary motor starts if: • No auxiliary motors are running. • ACS550 output frequency exceeds the limit: 8109 + 1 Hz. • Output frequency stays above a relaxed limit (8109 - 1 Hz) for at least the time: 8115 AUX MOT START D. After the first auxiliary motor starts: • Output frequency decreases by the value = (8109 START FREQ 1) - (8112 LOW FREQ 1). • In effect, the output of the speed regulated motor drops to compensate for the input from the auxiliary motor. See figure, where: • A = (8109 START FREQ 1) - (8112 LOW FREQ 1) • B = Output frequency increase during the start delay. • C = Diagram showing auxiliary motor's run status as frequency increases (1 = On). **Note!** 8109 START FREQ 1 value must be between: • 8112 LOW FREQ 1 • (2008 MAXIMUM FREQ) -1. 
8110	**START FREQ 2** Sets the frequency limit used to start the second auxiliary motor. • See 8109 START FREQ 1 for a complete description of the operation. The second auxiliary motor starts if: • One auxiliary motor is running. • ACS550 output frequency exceeds the limit: 8110 + 1. • Output frequency stays above the relaxed limit (8110 - 1 Hz) for at least the time: 8115 AUX MOT START D.
8111	**START FREQ 3** Sets the frequency limit used to start the third auxiliary motor. • See 8109 START FREQ 1 for a complete description of the operation. The third auxiliary motor starts if: • Two auxiliary motors are running. • ACS550 output frequency exceeds the limit: 8111 + 1 Hz. • Output frequency stays above the relaxed limit (8111 - 1 Hz) for at least the time: 8115 AUX MOT START D.

Code	Description
8112	**LOW FREQ 1** Sets the frequency limit used to stop the first auxiliary motor. The first auxiliary motor stops if: • The first auxiliary motor is running alone. • ACS550 output frequency drops below the limit: 8112 - 1. • Output frequency stays below the relaxed limit (8112 + 1 Hz) for at least the time: 8116 AUX MOT STOP D. After the first auxiliary motor stops: • Output frequency increases by the value = (8109 START FREQ 1) - (8112 LOW FREQ 1). • In effect, the output of the speed regulated motor increases to compensate for the loss of the auxiliary motor. See figure, where: • A = (8109 START FREQ 1) - (8112 LOW FREQ 1) • B = Output frequency decrease during the stop delay. • C = Diagram showing auxiliary motor's run status as frequency decreases (1 = On). • Grey path = Shows hysteresis – if time is reversed, the path backwards is not the same. For details on the path for starting, see the diagram at 8109 START FREQ 1.  **Note!** Low Frequency 1 value must be between: • (2007 MINIMUM FREQ) +1. • 8109 START FREQ 1
8113	**LOW FREQ 2** Sets the frequency limit used to stop the second auxiliary motor. • See 8112 LOW FREQ 1 for a complete description of the operation. The second auxiliary motor stops if: • Two auxiliary motors are running. • ACS550 output frequency drops below the limit: 8113 - 1. • Output frequency stays below the relaxed limit (8113 + 1 Hz) for at least the time: 8116 AUX MOT STOP D.
8114	**LOW FREQ 3** Sets the frequency limit used to stop the third auxiliary motor. • See 8112 LOW FREQ 1 for a complete description of the operation. The third auxiliary motor stops if: • Three auxiliary motors are running. • ACS550 output frequency drops below the limit: 8114 - 1. • Output frequency stays below the relaxed limit (8114 + 1 Hz) for at least the time: 8116 AUX MOT STOP D.
8115	**AUX MOT START D** Sets the Start Delay for the auxiliary motors. • The output frequency must remain above the start frequency limit (parameter 8109, 8110, or 8111) for this time period before the auxiliary motor starts. • See 8109 START FREQ 1 for a complete description of the operation.
8116	**AUX MOT STOP D.** Sets the Stop Delay for the auxiliary motors. • The output frequency must remain below the low frequency limit (parameter 8112, 8113, or 8114) for this time period before the auxiliary motor stops. • See 8112 LOW FREQ 1 for a complete description of the operation.

Code	Description
8117	**NR OF AUX MOT** Sets the number of auxiliary motors. • Each auxiliary motor requires a relay output, which the drive uses to send start/stop signals. • The Autochange function, if used, requires an additional relay output for the speed regulated motor. • The following describes the set-up of the required relay outputs. **Relay Outputs** As noted above, each auxiliary motor requires a relay output, which the drive uses to send start/stop signals. The following describes how the drive keeps track of motors and relays. • The ACS550 provides relay outputs RO1…RO3. • An external digital output module can be added to provide relay outputs RO4…RO6. • Parameters 1401…1403 and 1410…1412 define, respectively, how relays RO1…RO6 are used – the parameter value 31 PFC defines the relay as used for PFC. • The ACS550 assigns auxiliary motors to relays in ascending order. If the Autochange function is disabled, the first auxiliary motor is the one connected to the first relay with a parameter setting = 31 PFC, and so on. If the Autochange function is used, the assignments rotate. Initially, the speed regulated motor is the one connected to the first relay with a parameter setting = 31 PFC, the first auxiliary motor is the one connected to the second relay with a parameter setting = 31 PFC, and so on.  Standard PFC mode  PFC with Autochange mode

Code	Description

• The table below shows the ACS550 PFC motor assignments for some typical settings in the Relay Output parameters (1401…1403 and 1410…1412), where the settings are either =31 (PFC), or =X (anything but 31), and where the Autochange function is disabled (8118 AUTOCHNG INTERV = 0).

Parameter Setting							ACS550 Relay Assignment					
							Autochange Disabled					
1401	1402	1403	1410	1411	1412	8117	RO1	RO2	RO3	RO4	RO5	RO6
31	X	X	X	X	X	1	Aux.	X	X	X	X	X
31	31	X	X	X	X	2	Aux.	Aux.	X	X	X	X
31	31	31	X	X	X	3	Aux.	Aux.	Aux.	X	X	X
X	31	31	X	X	X	2	X	Aux.	Aux.	X	X	X
X	X	X	31	X	31	2	X	X	X	Aux.	X	Aux.
31	31	X	X	X	X	1	Aux.	Aux.	X	X	X	X

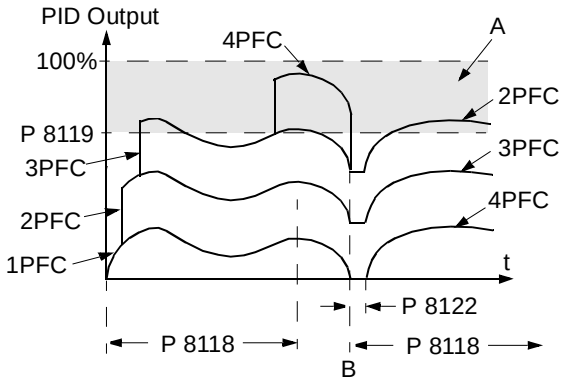
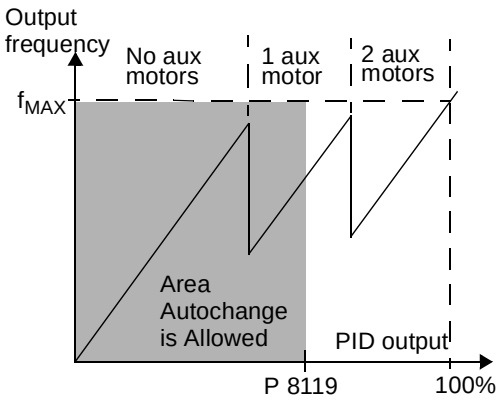
• The table below shows the ACS550 PFC motor assignments for some typical settings in the Relay Output parameters (1401…1403 and 1410…1412), where the settings are either =31 (PFC), or =X (anything but 31), and where the Autochange function is enabled (8118 AUTOCHNG INTERV = value > 0).

Parameter Setting							ACS550 Relay Assignment					
							Autochange Disabled					
1401	1402	1403	1410	1411	1412	8117	RO1	RO2	RO3	RO4	RO5	RO6
31	31	X	X	X	X	1	PFC	PFC	X	X	X	X
31	31	31	X	X	X	2	PFC	PFC	PFC	X	X	X
x	31	31	X	X	X	1	X	PFC	PFC	X	X	X
X	X	X	31	X	31	1	X	X	X	PFC	X	PFC
31	31	X	X	X	X	0	PFC	PFC	X	X	X	X

8118 **AUTOCHNG INTERV**

Controls operation of the Autochange function and sets the interval between changes.
- The Autochange time interval only applies to the time when the speed regulated motor is running.
- See parameter 8119 AUTOCHNG LEVEL for an overview of the Autochange function.
- The drive always coasts to a stop when autochange is performed.
- Autochange enabled requires parameter 8120 INTERLOCKS = value > 0.

0.0 = NOT SEL – Disables the Autochange function.
0.1…336 = The operating time interval (the time when the start signal is on) between automatic motor changes.
Warning! When enabled, the Autochange function requires the interlocks (8120 interlocks = value > 0) enabled. During autochange the interlocks interrupt the drive's power output, preventing damage to the contacts.

Code	Description
8119	**AUTOCHNG LEVEL** Sets an upper limit, as a percent of output capacity, for the autochange logic. When the output from the PID/PFC control block exceeds this limit, autochange is prevented. For example, use this parameter to deny autochange when the Pump-Fan system is operating near maximum capacity. **Autochange Overview** The purpose of the autochange operation is to equalize duty time between multiple motors used in a system. At each autochange operation: • A different motor takes a turn connected to the ACS550 output – the speed regulated motor. • The starting order of the other motors rotates. The Autochange function requires: • External switchgear for changing the dive's output power connections. • Parameter 8120 INTERLOCKS = value > 0. Autochange is performed when: • The running time since the previous autochange reaches the time set by 8118 AUTOCHNG INTERV • The PFC input is below the level set by this parameter, 8119 AUTOCHNG LEVEL. **Note!** The ACS550 always coasts to stop when autochange is performed. In an autochange, the Autochange function does all of the following (see figure): • Initiates a change when the running time, since the last autochange, reaches 8118 AUTOCHNG INTERV, and PFC input is below limit 8119 AUTOCHNG LEVEL. • Stops the speed regulated motor. • Switches off the contactor of the speed regulated motor. • Increments the starting order counter, to change the starting order for the motors. • Identifies the next motor in line to be the speed regulated motor. • Switches off the above motor's contactor, if the motor was running. Any other running motors are not interrupted. • Switches on the contactor of the new speed regulated motor. The autochange switchgear connects this motor to the ACS550 power output. • Delays motor start for the time 8122 PFC START DELAY. • Starts the speed regulated motor. • Identifies the next constant speed motor in the rotation. • Switches the above motor on, but only if the new speed regulated motor had been running (as a constant speed motor) – This step keeps an equal number of motors running before and after autochange. • Continues with normal PFC operation.  A = Area above 8119 AUTOCHNG LEVEL – autochange not allowed. B = Autochange occurs. 1PFC, etc. = PID output associated with each motor. **Starting Order Counter** The operation of the starting-order counter: • The relay output parameter definitions (1401…1403 and 1410…1412)) establish the initial motor sequence. (The lowest parameter number with a value 31 (PFC) identifies the relay connected to 1PFC, the first motor, and so on.) • Initially, 1PFC = speed regulated motor, 2PFC = 1st auxiliary motor, etc. • The first autochange shifts the sequence to: 2PFC = speed regulated motor, 3PFC = 1st auxiliary motor, …, 1PFC = last auxiliary motor. • The next autochange shifts the sequence again, and so on. • If the autochange cannot start a needed motor because all inactive motors are interlocked, the drive displays an alarm (INTERLOCK).  • When ACS550 power supply is switched off, the counter preserves the current Autochange rotation positions in permanent memory. When power is restored, the Autochange rotation starts at the position stored in memory. • If the PFC relay configuration is changed (or if the PFC enable value is changed), the rotation is reset. (See the first bullet above.)

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>8120</td><td>
INTERLOCKS
Defines operation of the Interlock function. When the Interlock function is enabled:
• An interlock is active when its command signal is absent.
• An interlock is inactive when its command signal is present.
• The ACS550 will not start if a start command occurs when the speed regulated motor's interlock is active – the control panel displays an alarm (INTERLOCK).
Wire each Interlock circuit as follows:
• Wire a contact of the motor's On/Off switch to the Interlock circuit – the drive's PFC logic can then recognize that the motor is switched off, and start the next available motor.
• Wire a contact of the motor thermal relay (or other protective device in the motor circuit) to the Interlock input – the drive's PFC logic can then recognize that a motor fault is activated and stop the motor.
0 = NOT SEL – Disables the Interlock function. All digital inputs are available for other purposes.
• Requires 8118 AUTOCHNG INTERV = 0 (The Autochange function must be disabled if Interlock function is disabled.)
1 = DI1 – Enables the Interlock function, and assigns a digital input (starting with DI1) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
• The number of PFC relays (number of parameters 1401…1403 and 1410…1412) and with value = 31 PFC)
• The Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0, and otherwise enabled).
<table>
<tr><th>No. PFC Relays</th><th>Autochange Disabled (P 8118)</th><th>Autochange Enabled (P 8118)</th></tr>
<tr><td>0</td><td>DI1: Speed Reg Motor
DI2…DI6: Free</td><td>Not allowed</td></tr>
<tr><td>1</td><td>DI1: Speed Reg Motor
DI2: First PFC Relay
DI3…DI6: Free</td><td>DI1: First PFC Relay
DI2…DI6: Free</td></tr>
<tr><td>2</td><td>DI1: Speed Reg Motor
DI2: First PFC Relay
DI3: Second PFC Relay
DI4…DI6: Free</td><td>DI1: First PFC Relay
DI2: Second PFC Relay
DI3…DI6: Free</td></tr>
<tr><td>3</td><td>DI1: Speed Reg Motor
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5…DI6: Free</td><td>DI1: First PFC Relay
DI2: Second PFC Relay
DI3: Third PFC Relay
DI4…DI6: Free</td></tr>
<tr><td>4</td><td>DI1: Speed Reg Motor
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5: Fourth PFC Relay
DI6: Free</td><td>DI1: First PFC Relay
DI2: Second PFC Relay
DI3: Third PFC Relay
DI4: Fourth PFC Relay
DI5…DI6: Free</td></tr>
<tr><td>5</td><td>DI1: Speed Reg Motor
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5: Fourth PFC Relay
DI6: Fifth PFC Relay</td><td>DI1: First PFC Relay
DI2: Second PFC Relay
DI3: Third PFC Relay
DI4: Fourth PFC Relay
DI5: Fifth PFC Relay
DI6: Free</td></tr>
<tr><td>6</td><td>Not allowed</td><td>DI1: First PFC Relay
DI2: Second PFC Relay
DI3: Third PFC Relay
DI4: Fourth PFC Relay
DI5: Fifth PFC Relay
DI6: Sixth PFC Relay</td></tr>
</table>
</td></tr>
</table>

Code	Description

2 = DI2 – Enables the Interlock function, and assigns a digital input (starting with DI2) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
- The number of PFC relays (number of parameters 1401…1403 and 1410…1412) with value = 31 PFC)
- The Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0, and otherwise enabled).

No. PFC Relays	Autochange Disabled (P 8118)	Autochange Enabled (P 8118)
0	DI1: Free DI2: Speed Reg Motor DI3…DI6: Free	Not allowed
1	DI1: Free DI2: Speed Reg Motor DI3: First PFC Relay DI4…DI6: Free	DI1: Free DI2: First PFC Relay DI3…DI6: Free
2	DI1: Free DI2: Speed Reg Motor DI3: First PFC Relay DI4: Second PFC Relay DI5…DI6: Free	DI1: Free DI2: First PFC Relay DI3: Second PFC Relay DI4…DI6: Free
3	DI1: Free DI2: Speed Reg Motor DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Free	DI1: Free DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5…DI6: Free
4	DI1: Free DI2: Speed Reg Motor DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Fourth PFC Relay	DI1: Free DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5: Fourth PFC Relay DI6: Free
5	Not allowed	DI1: Free DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5: Fourth PFC Relay DI6: Fifth PFC Relay
6	Not allowed	Not allowed

Code	Description

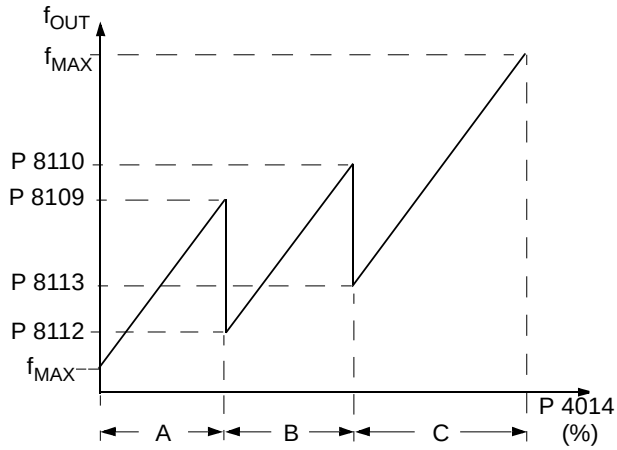
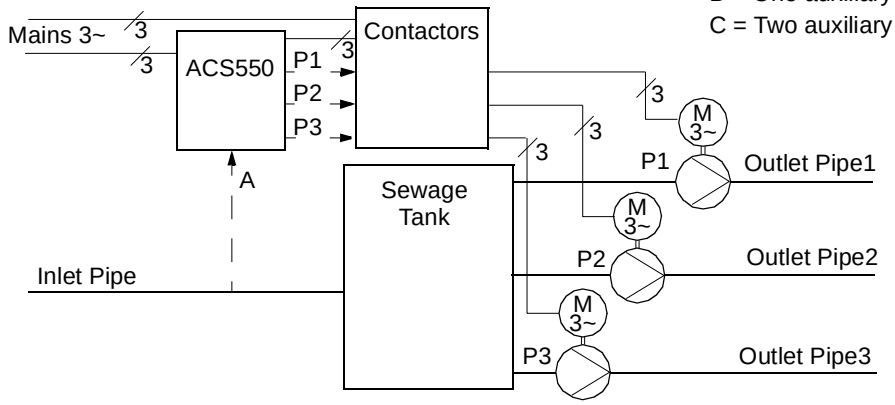
3 = DI3 – Enables the Interlocks function, and assigns a digital input (starting with DI3) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
- The number of PFC relays (number of parameters 1401…1403 and 1410…1412) with value = 31 PFC)
- The Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0, and otherwise enabled).

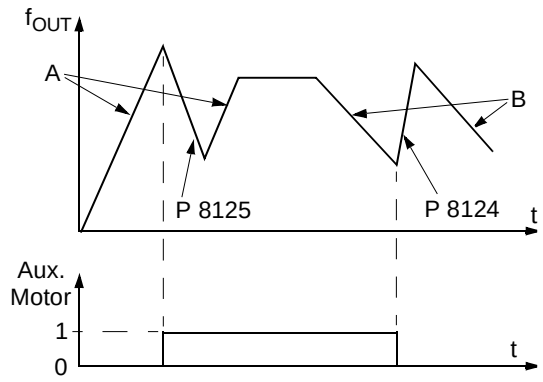
No. PFC Relays	Autochange Disabled (P 8118)	Autochange Enabled (P 8118)
0	DI1…DI2: Free DI3: Speed Reg Motor DI4…DI6: Free	Not allowed
1	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5…DI6: Free	DI1…DI2: Free DI3: First PFC Relay DI4…DI6: Free
2	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5: Second PFC Relay DI6: Free	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5…DI6: Free
3	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5: Second PFC Relay DI6: Third PFC Relay	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Free
4	Not allowed	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Fourth PFC Relay
5…6	Not allowed	Not allowed

4 = DI4 – Enables the Interlock function, and assigns a digital input (starting with DI4) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
- The number of PFC relays (number of parameters 1401…1403 and 1410…1412) with value = 31 PFC)
- The Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0, and otherwise enabled).

No. PFC Relays	Autochange Disabled (P 8118)	Autochange Enabled (P 8118)
0	DI1…DI3: Free DI4: Speed Reg Motor DI5…DI6: Free	Not allowed
1	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFC Relay DI6: Free	DI1…DI3: Free DI4: First PFC Relay DI5…DI6: Free
2	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFC Relay DI6: Second PFC Relay	DI1…DI3: Free DI4: First PFC Relay DI5: Second PFC Relay DI6: Free
3	Not allowed	DI1…DI3: Free DI4: First PFC Relay DI5: Second PFC Relay DI6: Third PFC Relay
4…6	Not allowed	Not allowed

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
5 = DI5 – Enables the Interlock function, and assigns a digital input (starting with DI5) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
• The number of PFC relays (number of parameters 1401…1403 and 1410…1412) with value = 31 PFC)
• The Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0, and otherwise enabled).
<table>
<tr><th>No. PFC Relays</th><th>Autochange Disabled (P 8118)</th><th>Autochange Enabled (P 8118)</th></tr>
<tr><td>0</td><td>DI1…DI4: Free
DI5: Speed Reg Motor
DI6: Free</td><td>Not allowed</td></tr>
<tr><td>1</td><td>DI1…DI4: Free
DI5: Speed Reg Motor
DI6: First PFC Relay</td><td>DI1…DI4: Free
DI5: First PFC Relay
DI6: Free</td></tr>
<tr><td>2</td><td>Not allowed</td><td>DI1…DI4: Free
DI5: First PFC Relay
DI6: Second PFC Relay</td></tr>
<tr><td>3…6</td><td>Not allowed</td><td>Not allowed</td></tr>
</table>
6 = DI6 – Enables the Interlock function, and assigns digital input DI6 to the interlock signal for the speed regulated motor.
• Requires 8118 AUTOCHNG INTERV = 0.
<table>
<tr><th>No. PFC Relays</th><th>Autochange Disabled</th><th>Autochange Enabled</th></tr>
<tr><td>0</td><td>DI1…DI5: Free
DI6: Speed Reg Motor</td><td>Not allowed</td></tr>
<tr><td>1</td><td>Not allowed</td><td>DI1…DI5: Free
DI6: First PFC Relay</td></tr>
<tr><td>2...6</td><td>Not allowed</td><td>Not allowed</td></tr>
</table>
</td></tr>
</table>

Code	Description
8121	**REG BYPASS CTRL** Selects Regulator by-pass control. When enabled, Regulator by-pass control provides a simple control mechanism without a PID regulator. • Use Regulator by-pass control only in special applications. 0 = NO – Disables Regulator by-pass control. The drive uses the normal PFC reference: 1106 REF2 SELECT. 1 = YES – Enables Regulator by-pass control. • The process PID regulator is bypassed. Actual value of PID is used as the PFC reference (input). Normally EXT REF2 is used as the PFC reference. • The drive uses the feedback signal defined by 4014 FBK SEL (or 4114) for the PFC frequency reference. • The figure shows the relation between the control signal 4014 FBK SEL (OR 4114) and the speed regulated motor's frequency in a three-motor system. Example: In the diagram below, the pumping station's outlet flow is controlled by the measured inlet flow (A).  A = No auxiliary motors running B = One auxiliary motor running C = Two auxiliary motors running 
8122	**PFC START DELAY** Sets the start delay for speed regulated motors in the system. Using the delay, the drive works as follows: • Switches on the contactor of the speed regulated motor – connecting the motor to the ACS550 power output. • Delays motor start for the time 8122 PFC START DELAY. • Starts the speed regulated motor. • Starts auxiliary motors. See parameter 8115 for delay. **Warning! Motors equipped with star-delta starters require a PFC Start Delay.** • After the ACS550 relay output switches a motor On, the star-delta starter must switch to the star-connection and then back to the delta-connection before the drive applies power. • So, the PFC Start Delay must be longer than the time setting of the star-delta starter.
8123	**PFC ENABLE** Selects PFC control. When enabled, PFC control: • Switches in, or out, auxiliary constant speed motors as output demand increases or decreases. Parameters 8109 START FREQ 1 to 8114 LOW FREQ 3 define the switch points in terms of the drive output frequency. • Adjusts the speed regulated motor output down, as auxiliary motors are added, and adjusts the speed regulated motor output up, as auxiliary motors are taken off line. • Provides Interlock functions, if enabled. • Requires 9904 MOTOR CTRL MODE = 3 SCALAR. 0 = NOT SEL – Disables PFC control. 1 = ACTIVE – Enables PFC control.

Code	Description	
8124	**ACC IN AUX STOP** Sets the PFC acceleration time for a zero-to-maximum frequency ramp. This PFC acceleration ramp: • Applies to the speed regulated motor, when an auxiliary motor is switched off. • Replaces the acceleration ramp defined in Group 22: Accel / Decel. • Applies only until the output of the regulated motor increases by an amount equal to the output of the switched off auxiliary motor. Then the acceleration ramp defined in Group 22: Accel / Decel applies.	 • A = speed regulated motor accelerating using Group 22 parameters (2202 or 2205). • B = speed regulated motor decelerating using Group 22 parameters (2203 or 2206). • At aux. motor start, speed regulated motor decelerates using 8125 DEC IN AUX START. • At aux. motor stop, speed regulated motor accelerates using 8124 ACC IN AUX STOP.
8125	**DEC IN AUX START** Sets the PFC deceleration time for a maximum-to-zero frequency ramp. This PFC deceleration ramp: • Applies to the speed regulated motor, when an auxiliary motor is switched on. • Replaces the deceleration ramp defined in Group 22 ACCEL / DECEL. • Applies only until the output of the regulated motor decreases by an amount equal to the output of the auxiliary motor. Then the deceleration ramp defined in Group 22 ACCEL / DECEL applies.	

Group 98: Options

This group configures for options, in particular, enabling serial communication with the drive.

Code	Description
9802	**COMM PROT SEL** Selects the communication protocol. 0 = NOT SEL – No communication protocol selected. 1 = STD MODBUS – The drive communicates via a Modbus controller via the RS485 serial link (X1-communications, terminal). • See also parameter Group 53 EFB PROTOCOL. 4 = EXT FBA – The drive communicates via a fieldbus adapter module in option slot 2 of the drive. • See also parameter Group 51 EXT COMM MODULE.

Diagnostics

Warning! Do not attempt any measurement, parts replacement or other service procedure not described in this manual. Such action will void the warranty, may endanger correct operation, and increase downtime and expense.

Warning! All electrical installation and maintenance work described in this chapter should only be undertaken by qualified service personnel. The Safety instructions on the first pages of this manual must be followed.

Diagnostic Displays

When a drive detects an error, it provides a diagnostic display. The display appears using:

- The green and red LED on the body of the drive
- The status LED on the control panel (if a control panel is attached to the drive)
- The control panel display (if a control panel is attached to the drive)

The form of the display depends on the severity of the error.

Red – Faults

The drive signals that it has detected a severe error, or fault, by:

- Enabling the red LED on the drive (LED is either steady on or blinking).
- Overriding the control panel display with the display of a fault code.
- Stopping the motor (if it was on).

The fault code on the control panel display is temporary. Pressing any of the following buttons removes the fault message: MENU, ENTER, UP button, or DOWN button. The message reappears after a few seconds if the control panel is not touched and the fault is still active.

Correcting Faults

The recommended corrective action for faults is:

- Use the "Fault Listing" table below to find and address the root cause of the problem.
- Reset the drive. See "Fault Resetting" on page 123.

Fault Listing

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
1	OVERCURRENT	Output current is excessive. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). • Undersized brake chopper (if present).
3	DEV OVERTEMP	Drive heatsink is overheated. Temperature is at or above 115 °C (239 °F). Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
4	SHORT CIRC	Fault current. Check for and correct: • A short-circuit in the motor cable(s) or motor. • Supply disturbances.
5	OVERLOAD	Inverter overload condition. The drive output current exceeds the ratings given in "Ratings" on page 127 of this manual.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for and correct: • Missing phase in the input power supply. • Blown fuse. • Undervoltage on mains.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than MINIMUM AI1 (1301). Check for and correct: • Source and connection for analog input. • Parameter settings for MINIMUM AI1 (1301) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than MINIMUM AI2 (1304). Check for and correct: • Source and connection for analog input. • Parameter settings for MINIMUM AI2 (1304) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, as estimated by the drive. • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009).
10	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays LOC), or • Drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections • Parameter 3002 PANEL COMM ERROR. • Parameters in Group 10: Command Inputs and Group 11: Reference Select (if drive operation is REM).

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
11	ID RUN FAIL	The motor ID run was not completed successfully. Check for and correct: • Motor connections
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for and correct: • Excessive load. • Insufficient motor power. • Parameters 3010…3012.
13	IO COMM ERR	Serial communication through the Standard Modbus Channel is lost. • Check connections between external control system and the drive.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	The load on the input power system is out of balance. • Check for/correct faults in the motor or motor cable. • Verify that motor cable does not exceed max. specified length.
17	UNDERLOAD	Motor load is lower than expected. Check for and correct: • Disconnected load. • Parameters 3013 UNDERLOAD FUNCTION…3015 UNDERLOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Call support representative.
19	OPEX LINK	Internal fault. A communication-related problem has been detected between the OMIO and OITF boards. Call support representative.
20	OPEX PWR	Internal fault. Low voltage condition detected on the OITF board. Call support representative.
21	CURR MEAS	Internal fault. Current measurement is out of range. Call support representative.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for and correct: • Missing mains phase. • Blown fuse.
23	ENCODER ERR	Not used.
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED. Check for and correct: • Parameter settings for 2001 and 2002. • Adequacy of motor braking torque. • Applicability of torque control. • Brake chopper and resistor.
25	DC HIGH RUSH	Not used.
26	DRIVE ID	Internal fault. Configuration Block Drive ID is not valid. Call support representative.
27	CONFIG FILE	
28	SERIAL 1 ERR	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (Group 51 or 53 as appropriate). • Poor connections and/or noise on line.

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
29	EFB CON FILE	
30	FORCE TRIP	
31	EFB 1	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
32	EFB 2	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
33	EFB 3	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for and correct: • Motor fault. • Motor cable fault. • Thermal relay fault (if used). • Internal fault.
35	OUTP WIRING	Error in power wiring suspected. Check for and correct: • Input power wired to drive output. • Ground faults.
1000	PAR HZRPM	Parameter values are inconsistent. Check for any of the following: • 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED. • 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ. • 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: -128…128. • 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: -128…128. • 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: -128…128. • 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: -128…128.
1001	PAR PFCREFNG	Parameter values are inconsistent. Check for the following: • 2007 MINIMUM FREQ is negative, when 8123 PFC ENABLE is active.
1002	PAR PFCIOCNF	Parameter values are inconsistent. The number of programmed PFC relays does not match with Interlock configuration, when 8123 PFC ENABLE is active. Check consistency of: • RELAY OUTPUT parameters 1401…1403, and 1410…1412. • 8117 NR OF AUX MOTORS, 8118 AUTOCHANGE INTERV, and 8120 INTERLOCKS.
1003	PAR AI SCALE	Parameter values are inconsistent. Check for any of the following: • 1301 AI 1 MIN > 1302 AI 1 MAX. • 1304 AI 2 MIN > 1305 AI 2 MAX.
1004	PAR AO SCALE	Parameter values are inconsistent. Check for any of the following: • 1504 AO 1 MIN > 1505 AO 1 MAX. • 1510 AO 2 MIN > 1511 AO 2 MAX.
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check for the following: • $1.1 \leq (9906 \text{ MOTOR NOM CURR} * 9905 \text{ MOTOR NOM VOLT} * 1.73 / P_N) \leq 2.6$ • Where: $P_N = 1000 * 9909$ MOTOR NOM POWER (if units are kW) or $P_N = 746 * 9909$ MOTOR NOM POWER (if units are HP, e.g. in US)

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
1006	PAR EXT RO	Parameter values are inconsistent. Check for the following: • Extension relay module not connected and • 1410…1412 RELAY OUTPUTS 4…6 have non-zero values.
1007	PAR FBUSMISS	Parameter values are inconsistent. Check for and correct: • A parameter is set for fieldbus control (e.g. 1001 EXT1 COMMANDS = 10 (COMM)), but 9902 COMM PROT SEL = 0.
1008	PAR PFCMODE	Parameter values are inconsistent – 9904 MOTOR CONTROL MODE must be = 3 (SCALAR), when 8123 PFC ENABLE is activated.
1009	PAR PCU 1	Parameter values for power control are inconsistent: Improper motor nominal frequency or speed. Check for both of the following: • 1 ≤ (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED ≤ 16 • 0.8 ≤ 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor Poles) ≤ 0.992

Fault Resetting

The ACS550 can be configured to automatically reset certain faults. Refer to parameter Group 31: Automatic Reset.

Warning! If an external source for start command is selected and it is active, the ACS550 may start immediately after fault reset.

Flashing Red LED

To reset the drive for faults indicated by a flashing red LED:

- Turn the power off for 5 minutes.

Red LED

To reset the drive for faults indicated by a red LED (on, not flashing), correct the problem and do one of the following:

- From the control panel: Press RESET
- By digital input: OFF and ON
- serial communication:
- Turn the power off for 5 minutes.

When the fault has been removed, the motor can be started.

History

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. You can clear the fault memories:

- In the control panel, Parameters mode, select a parameter (0401, 0412, 0413).
- Enter the set mode.

Press the UP and DOWN buttons simultaneously**.**

Maintenance

Warning! Read "Safety" on page 3 before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance Intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Maintenance	Interval	Instruction
Heatsink temperature check and cleaning	Depends on the dustiness of the environment (every 6…12 months)	See "Heatsink" on page 124.
Main cooling fan replacement	Every five years	See "Main Fan" on page 124.
Capacitor change (Frame size R5 and R6)	Every ten years	See "Capacitors" on page 125.

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a "normal" environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from drive.
2. Remove the cooling fan (see section "Main Fan" on page 124).
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.

Note: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

4. Replace the cooling fan.
5. Restore power.

Main Fan

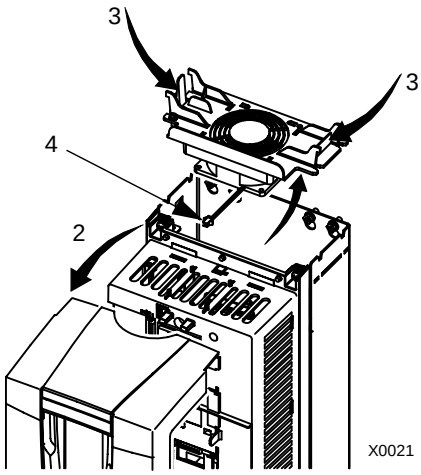
The drive's main cooling fan has a life span of about 60,000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 10 °C (18 °F) drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Main Fan Replacement (Frame Size R1...R4)

To replace the fan:

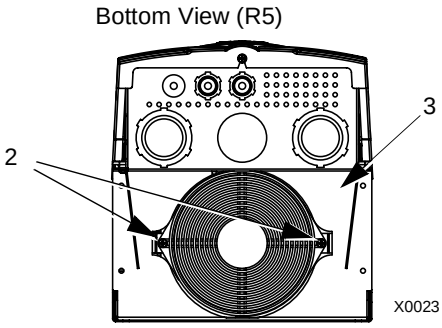
1. Remove power from drive.
2. Remove drive cover.
3. Press together the retaining clips on the fan cover and lift.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.



Main Fan Replacement (Frame Size R5 and R6)

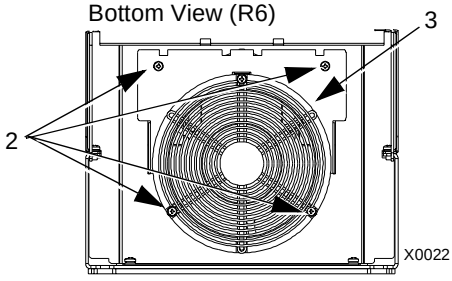
To replace the fan:

1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Disconnect the fan cable.
4. Install the fan in reverse order.
5. Restore power.



Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35,000...90,000 hours depending on drive loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.



It is not possible to predict a capacitor failure. Capacitor failure is usually followed by a input power fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements for frame size R5 and R6 are available from ABB. Do not use other than ABB specified spare parts.

Control Panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is only used in control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Technical Data

Ratings

By type code, the table below provides ratings for the ACS550 adjustable speed AC drive, including:

- IEC ratings
- NEMA ratings (shaded columns)
- Frame size
- Drive cabinet heat dissipation and air flow

Abbreviated column headers are described in "Symbols" on page 128.

Type Code	Normal Use			Heavy-Duty Use			Frame Size
ACS550-x1- see below	I_{2N} A	P_N kW	P_N HP	I_{2hd} A	P_{hd} kW	P_{hd} HP	
Three-phase supply voltage, **380**…**480 V**							
-03A3-4	3.3	1.1	1.5	2.4	0.75	1	R1
-04A1-4	4.1	1.5	2	3.3	1.1	1.5	R1
-05A4-4	5.4	2.2	3	4.1	1.5	2	R1
-06A9-4	6.9	3	3	5.4	2.2	3	R1
-08A8-4	8.8	4	5	6.9	3	3	R1
-012A-4	11.9	5.5	7.5	8.8	4	5	R1
-015A-4	15.4	7.5	10	11.9	5.5	7.5	R2
-023A-4	23	11	15	15.4	7.5	10	R2
-031A-4	31	15	20	23	11	15	R3
-038A-4	38	18.5	25	31	15	20	R3
-044A-4	44	22	30	38	18.5	25	R4
-059A-4	59	30	40	44	22	30	R4
-072A-4	72	37	50	59	30	40	R4
-096A-4	96	45	75	69	41	50	R5
-124A-4	124	55	100	88	45	60	R6
-157A-4	157	75	125	113	55	75	R6
-180A-4	180	90	150	141	75	100	R6

Symbols

Typical ratings:

Normal use (10% overload capability)

I_{2N}	continuous rms current. 10% overload is allowed for one minute.
P_N	typical motor power. The power ratings apply to most IEC 34, or NEMA 4-pole motors at the nominal voltage, 400 V or 460 V.

Heavy-duty use (50% overload capability)

I_{2hd}	continuous rms current. 50% overload is allowed for one minute.
P_{hd}	typical motor power. The power ratings apply to most IEC 34, or NEMA 4-pole motors at the nominal voltage, 400 V or 460 V.

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

Note 1: The maximum allowed motor shaft power is limited to $1.5 \cdot P_{hd}$. If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

Note 2: The ratings apply in ambient temperature of 40 °C (104 °F).

Derating

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 meters (3300 ft), or if the ambient temperature exceeds 40 °C (104 °F) or if 8 kHz switching frequency (parameter 2606) is used.

Temperature Derating

In the temperature range +40 °C...50 °C (+104 °F...122 °F) the rated output current is decreased 1% for every 1 °C (1.8 °F) above +40 °C (+104 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F) the derating factor is 100% - 1%/°C x 10 °C = 90% or 0.90.
The output current is then 0.90 x I_{2N} or 0.90 x I_{2hd}.

Altitude Derating

In altitudes from 1000...4000 m (3300...13,200 ft) above sea level, the derating is 1% for every 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or office for further information.

Single Phase Supply Derating

If the input supply is single phase, rather than 3-phase, the derating is 50%.

Switching Frequency Derating

If the 8 kHz switching frequency (parameter 2606) is used, derate P_N/P_{hd} and I_{2N}/I_{2hd} to 80%.

Input Power (Mains) Cables and Fuses

Branch circuit protection must be provided by the end-user, sized per national and local electric codes. Recommendations for fuses for short-circuit protection on the mains cable are below.

ACS550-x1-see below	Mains Cable (min.)			Mains Fuses		PE Earth Cable		
	Cu (mm^2)	Al (mm^2)	AWG	A	V	Cu (mm^2)	Al (mm^2)	AWG
See note	*1*	*1*		*2*	*2*			
Three-phase supply voltage, 380…480 V								
-03A3-4	1.5	–	14	10	600	2.5	–	12
-04A1-4	1.5	–	14	10	600	2.5	–	12
-05A4-4	1.5	–	14	10	600	2.5	–	12
-06A9-4	1.5	–	14	10	600	2.5	–	12
-08A8-4	1.5	–	14	10	600	2.5	–	12
-012A-4	2.5	–	12	16	600	2.5	–	12
-015A-4	2.5	–	10	16	600	4.0	–	10
-023A-4	6.0	–	8	25	600	6.0	–	8
-031A-4	10	–	8	35	600	10	–	8
-038A-4	16	–	6	50	600	16	–	6
-044A-4	16	–	6	50	600	16	–	6
-059A-4	25	–	4	63	600	16	–	6
-072A-4	35	–	3	80	600	16	–	6
-096A-4	50	70	1	125	600	25	–	4
-124A-4	70	95	1/0	150	600	35	–	3
-157A-4	95	120	4/0	200	600	50	–	1
-180A-4	120	150	250MCM	250	600	70	–	1/0

Note 1: Mains cable sizing is based on a correction factor of 0.71 (maximum of 4 cables laid on a cable ladder side by side, ambient temperature 30 °C (86 °F), EN 60204-1 and IEC 364-5-523). For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive. In any case, the cable must be between the minimum limit defined in this table and the maximum limit defined by the terminal size (see "Cable Terminals" on page 129).

Note 2: Fuse Type: UL Class T. For non-UL installations IEC 269 gG.

Cable Terminals

Brake resistor, mains and motor cable maximum sizes (per phase) accepted a the cable terminals, and the tightening torques are listed below.

Frame Size	U1, V1, W1 U2, V2, W2 BRK+, UDC+				Earthing PE				Control			
	Maximum Wire Size		Torque		Maximum Wire Size		Torque		Maximum Wire Size		Torque	
	mm^2	AWG	Nm	lb-ft	mm^2	AWG	Nm	lb-ft	mm^2	AWG	Nm	lb-ft
R1	6	8	1.4	1.0	4	10	1.4	1.0	1.5	16	0.4	0.3
R2	10	6	1.4	1.0	10	8	1.4	1.0				
R3	25	3	1.8	1.3	16	6	1.8	1.3				
R4	50	1/0	2.0	1.5	35	2	2.0	1.5				
R5	70	2/0	15	11.1	70	2/0	15	11.1				
R6	185	350 MCM	40	29.5	95	4/0	8	5.9				

Input Power (Mains) Connection

Input Power (Mains) Connection Specifications	
Voltage (U_1)	208/220/230/240 VAC 3-phase (or 1-phase) +10% -15% for 230 VAC units 400/415/440/460/480 VAC 3-phase +10% -15% for 400 VAC units
Prospective short-circuit current (IEC 629)	Maximum allowed prospective short-circuit current in the supply is 65 kA in a second providing that the mains cable of the drive is protected with appropriate fuses. US: 65,000 AIC.
Frequency	48…63 Hz
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)
Cable Temperature Rating	90 °C (194 °F) rating minimum.

Motor Connection

Motor Connection Specifications			
Voltage (U_2)	0…U_1, 3-phase symmetrical, U_{max} at the field weakening point		
Frequency	0…500 Hz		
Frequency resolution	0.01 Hz		
Current	See section *Ratings.*		
Power limit	1.5 x P_{hd}		
Field weakening point	10…500 Hz		
Switching frequency	Selectable: 1, 4, or 8 kHz		
Cable Temperature Rating	90 °C (194 °F) rating minimum.		
Maximum motor cable length	**Frame Size**	**Max. motor cable length**	
		f_{sw} = 1 or 4 kHz	**f_{sw} = 8 kHz**
	R1	100 m	50 m
	R2 - R4	200 m	100 m
	R5 - R6	300 m	150 m

*** Warning! Using a motor cable longer than specified in the chart above may cause permanent damage to the drive.**

Control Connection

Control Connection Specifications	
Analog Inputs and Outputs	See table heading "Hardware Description" on page 21.
Digital Inputs	Digital input impedance 1.5 kΩ. Maximum voltage for digital inputs is 30 V.
Relays (Digital Outputs)	• Max. contact voltage: 30 V DC, 250 V AC • Max. contact current / power: 6 A, 30 V DC; 1500 VA, 250 V AC • Max. continuous current: 2 A rms (cos φ = 1), 1 A rms (cos φ = 0.4) • Minimum load: 500 mW (12 V, 10 mA) • Contact material: Silver-nickel (AgN) • Isolation between relay digital outputs, test voltage: 2.5 kV rms, 1 minute
Cable Specifications	See "Control Cables" on page 13.

Efficiency

Approximately 98% at nominal power level.

Cooling

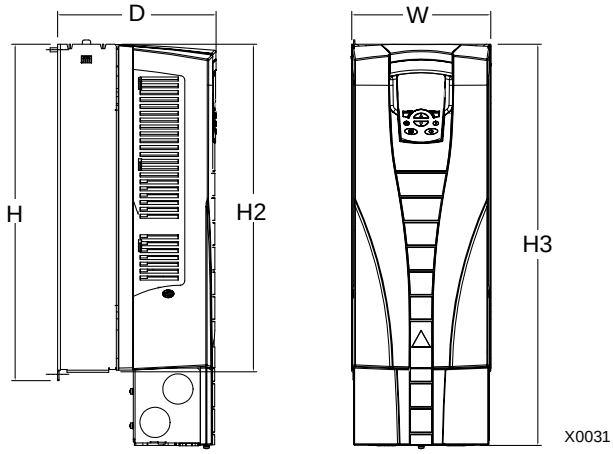
Cooling Specifications	
Method	Internal fan, flow direction from bottom to top.
Free space around the unit	• 200 mm (8 in) above and below the unit • 25 mm (1 in) along each side of the unit.

Dimensions, Weights and Noise

The dimensions and mass for the ACS550 depend on the frame size and enclosure type. If unsure of frame size, first, find the "Type" code on the drive labels. Then look up that type code in the **"Technical Data"** on page **127**, to determine the frame size. A complete set of dimensional drawings for ACS550 drives is located in the ACS550 Technical Reference manual.

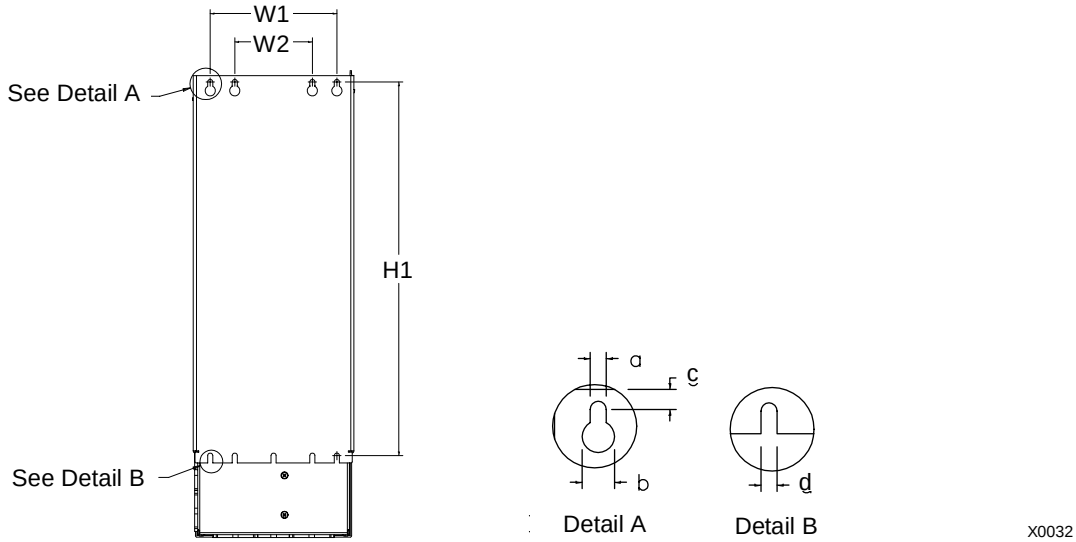
Units with IP 21 / UL Type 1 Enclosures

Outside Dimensions



IP 21 / UL type 1 – Dimensions for each Frame Size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W	125	4.9	125	4.9	203	8.0	203	8.0	265	10.4	300	11.8
H	330	13.0	430	16.9	490	19.3	596	23.4	602	23.7	700	27.6
H2	315	12.4	415	16.3	478	18.8	583	23.0	578	22.8	698	27.5
H3	369	14.5	469	18.5	583	23.0	689	27.1	739	29.1	880	34.6
D	212	8.3	222	8.7	231	9.1	262	10.3	286	11.3	400	15.8

Mounting Dimensions



IP 21 / UL type 1 – Dimensions for each Frame Size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W1*	98.0	3.9	98.0	3.9	160	6.3	160	6.3	238	9.4	263	10.4
W2*	--	--	--	--	98.0	3.9	98.0	3.9	--	--	--	--
H1*	318	12.5	418	16.4	473	18.6	578	22.8	588	23.2	675	26.6
a	5.5	0.2	5.5	0.2	6.5	0.25	6.5	0.25	6.5	0.25	9.0	0.35
b	10.0	0.4	10.0	0.4	13.0	0.5	13.0	0.5	14.0	0.55	14.0	0.55
c	5.5	0.2	5.5	0.2	8.0	0.3	8.0	0.3	8.5	0.3	8.5	0.3
d	5.5	0.2	5.5	0.2	6.5	0.25	6.5	025	6.5	0.25	9.0	0.35

* Center to center dimension.

Weight

IP 21 / UL type 1 – Weight for each Frame Size											
R1		**R2**		**R3**		**R4**		**R5**		**R6**	
kg	**lb.**	**kg**	**lb.**	**kg**	**lb.**	**kg**	**lb.**	**kg**	**lb.**	**kg**	**lb.**
6.1	13.4	8.9	19.5	14.7	32.4	22.8	50.2	37	82	78	176

Degrees of Protection

Available enclosures:

- IP 21 / UL type 1 enclosure. The site must be free of airborne dust, corrosive gases or liquids, and conductive contaminants such as condensation, carbon dust, and metallic particles.
- IP 54 / UL type 12 enclosure. This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.

Ambient Conditions

The following table lists the ACS550 environmental requirements.

Ambient Environment Requirements		
	Installation Site	**Storage and Transportation in the protective package**
Altitude	• 0…1000 m (0…3,300 ft) • 1000…2000 m (3,300…6,600 ft) if P_N and I_2 derated 1% every 100 m above 1000 m (300 ft above 3,300 ft)	
Ambient temperature	• -15…40 ºC (5…104 ºF) • Max. 50 ºC (122 ºF) if P_N and I_2 derated to 90%	-40…70 ºC (-40…158 ºF)
Relative humidity	< 95% (non-condensing)	
Contamination levels (IEC 721-3-3)	• No conductive dust allowed. • The ACS550 should be installed in clean air according to enclosure classification. • Cooling air must be clean, free from corrosive materials and free from electrically conductive dust. • Chemical gases: Class 3C2 • Solid particles: Class 3S2	Storage • No conductive dust allowed. • chemical gases: Class 1C2 • solid particles: Class 1S2 Transportation • No conductive dust allowed. • Chemical gases: Class 2C2 • Solid particles: Class 2S2
Sinusoidal vibration (IEC 60068-2-6)	• 2…9 Hz 0.3 mm (0.01 in) • 9…200 Hz 2 m/s^2 (6.6 ft/s^2)	Storage • 2…9 Hz 1.5 mm (0.06 in) • 9…200 Hz 5 m/s^2 (16.4 ft/s^2) Transportation • 2…9 Hz 3.5 mm (0.14 in) • 9…200 Hz 10 m/s^2 (32.8 ft/s^2)
Shock (IEC 68-2-29)	Not allowed	max. 100 m/s^2 (330 ft/s^2), 11ms (36 fts)
Free fall	Not allowed	• 76 cm (30 in), frame size R1 • 61cm (24 in), frame size R2 • 46 cm (18 in), frame size R3 • 31 cm (12 in), frame size R4 • 25 cm (10 in), frame size R5 • 25 cm (10 in), frame size R6

Materials

Materials Specifications	
Drive enclosure	• PC/ABS 2.5 mm, color NCS 1502-Y (RAL 90021 / PMS 420 C and 425 C) • Hot-dip zinc coated steel sheet 1.5…2 mm, thickness of coating 100 micrometers • Cast aluminium AlSi • Extruded aluminium AlSi
Package	Corrugated board (drives and option modules), expanded polystyrene. Plastic covering of the package: PE-LD, bands PP or steel.
Disposal	The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks. If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors contain electrolyte and the printed circuit boards contain lead, both of which will be classified as hazardous waste within the EU. They must be removed and handled according to local regulations. For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.

Applicable Standards

The drive complies with the following standards. The compliance with the European Low Voltage Directive is verified according to standards EN 50178 and EN 60204-1.

Applicable Standards	
EN 50178 (1997)	Electronic equipment for use in power installations
EN 60204-1 (1997)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. *Provisions for compliance:* The final assembler of the machine is responsible for installing: • An emergency-stop device • A supply disconnecting device
EN 60529: 1991 (IEC 529), IEC 60664-1 (1992)	Degrees of protection provided by enclosures (IP code)
EN 61800-3 (1996) + Amendment A11 (2000)	EMC product standard including specific test methods
UL 508C	UL Standard for Safety, Power Conversion Equipment, second edition

UL Markings

UL Markings status:

ACS550	UL	C-UL
R1…R4	Approved	Approved
R5…R6	Pending	Pending

UL

The ACS550 is suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amperes, 480 V maximum. The ACS550 has an electronic

motor protection feature that complies with the requirements of UL 508C. When this feature is selected and properly adjusted, additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations. See parameters 3005 (MOT THERM PROT) and 3006 (MOT THERM RATE).

The drives are to be used in a controlled environment. See section "Ambient Conditions" on page 134 for specific limits.

Brake chopper - ABB has brake choppers that, when applied with appropriately sized brake resistors, will allow the drive to dissipate regenerative energy (normally associated with quickly decelerating a motor).

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